RADIO and ELECTRICAL Review

TELEVISION - COMMUNICATIONS - SERVICE - SOUND

Incorporating "RADIO and ELECTRONICS"

JUNE 1st 1955

VOL. 10, NO. 4

PRICE 1/10

STANDARD TELEPHONES and CABLES PTY. LTD.

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Radio and Electrical Review

VOL. 10, No. 4 1st JUNE, 1955

OUR COVER this month illustrates the Hearing-aid Amplifier described on page 18.

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Official Journal of
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The N.Z. Radio and Television Manufacturers' Federation.
The N.Z. Radio and Electrical Traders' Federation.
N.Z. Radio, TV and Electrical Assn. (Inc.).

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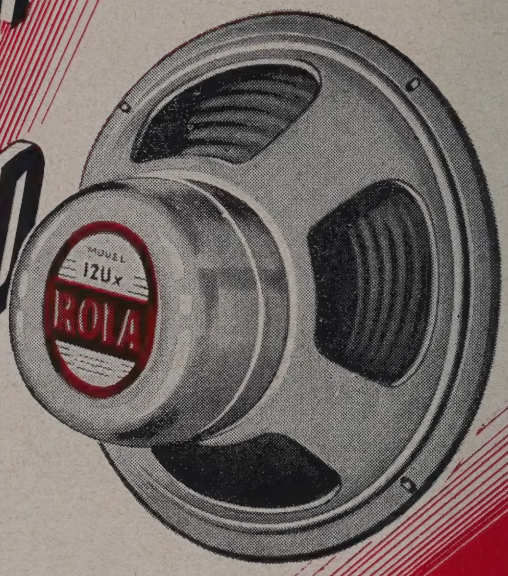
SPOTLIGHT on SOUND



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3S4	6B8GT	6Q7G	12AH8	35Z3
3V4	6BG6G	6Q7GT	12AT6	35Z4GT
5U4G	6BW6	6R7G	12AU6	50C5
5V4G	6C4	6SL7GT	12AT7	50L6GT
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6AM5	6J5G	6X4	12K8GT	80
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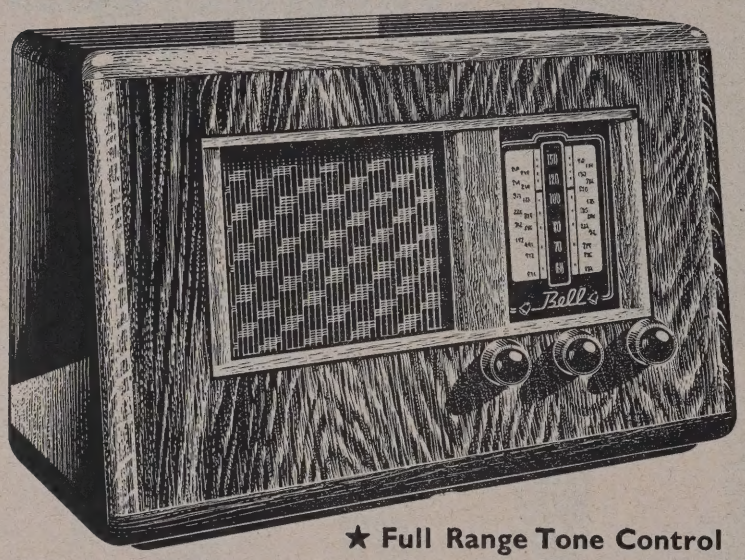

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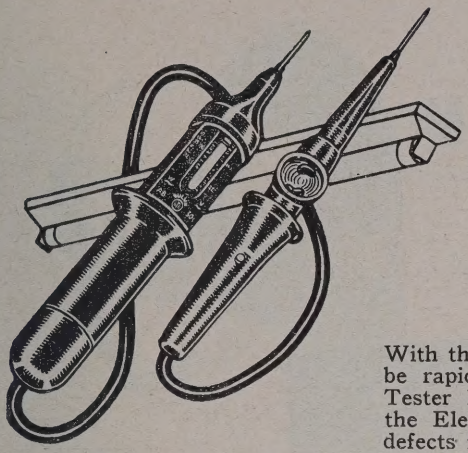

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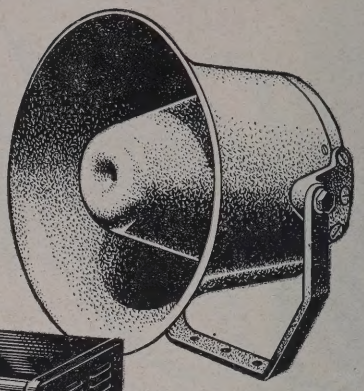

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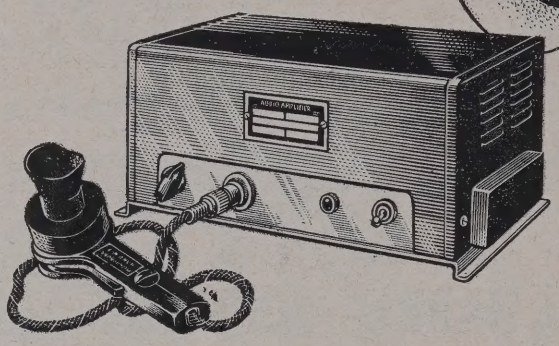

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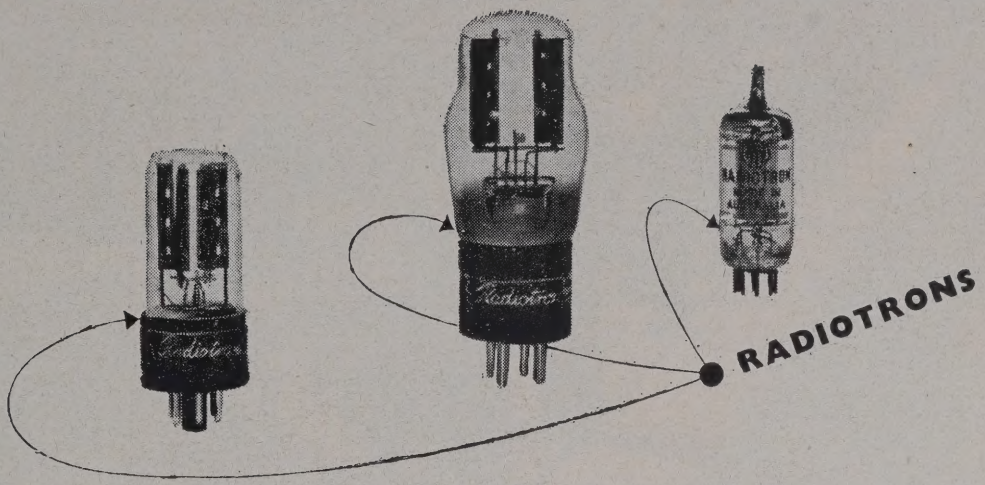

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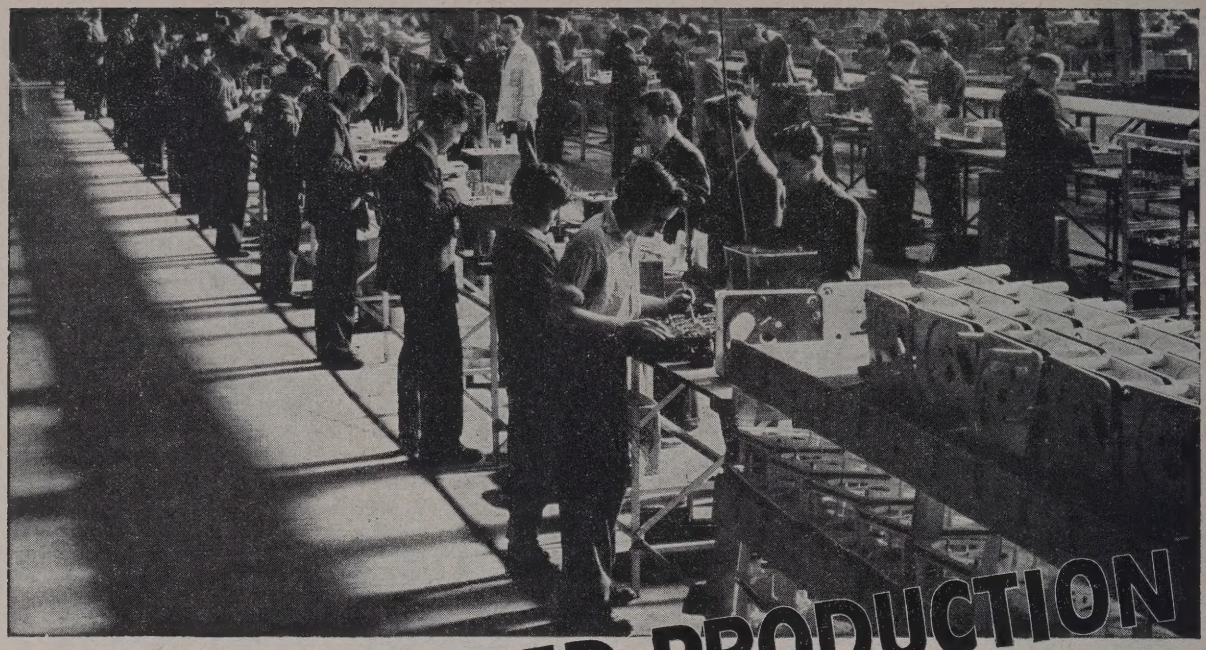

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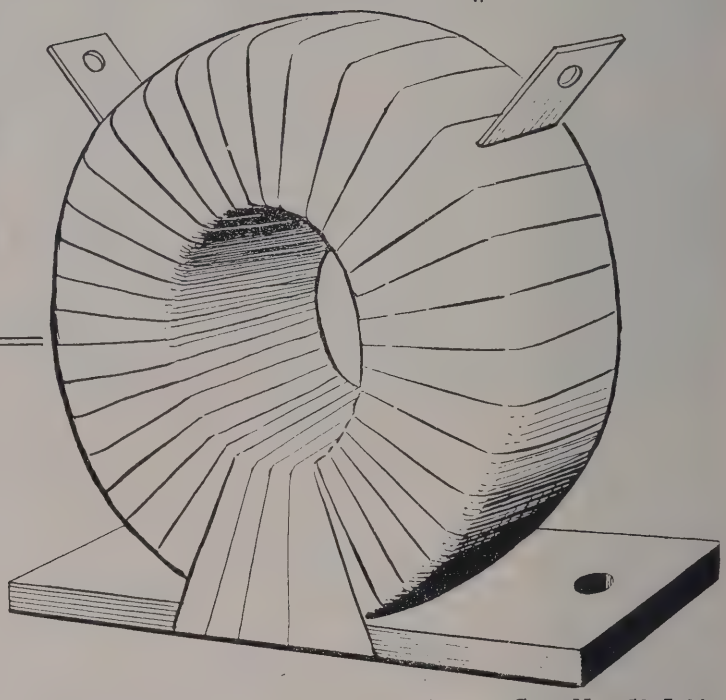

The characteristics of two BEACON Air Core Inductances are listed below.

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Q at 1,000 c/s.	19	27
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Width	$\frac{3}{4}$ in.	$1\frac{1}{4}$ in.
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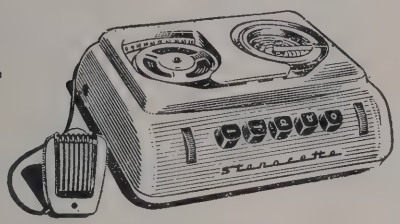

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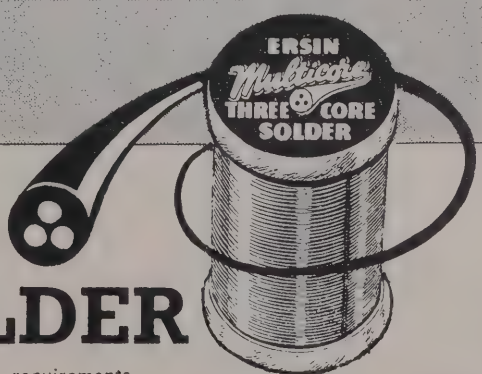

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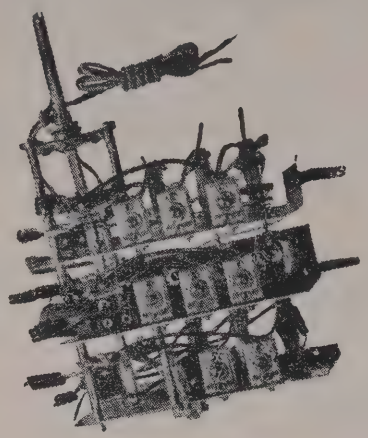

Poly-Q

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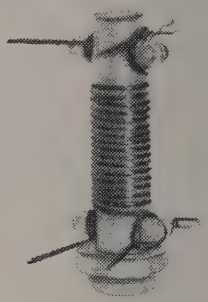

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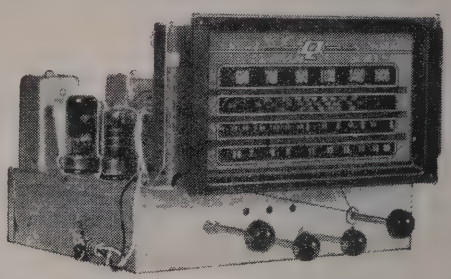

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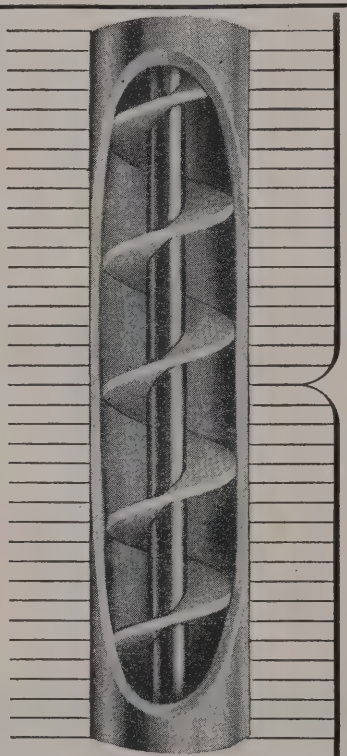

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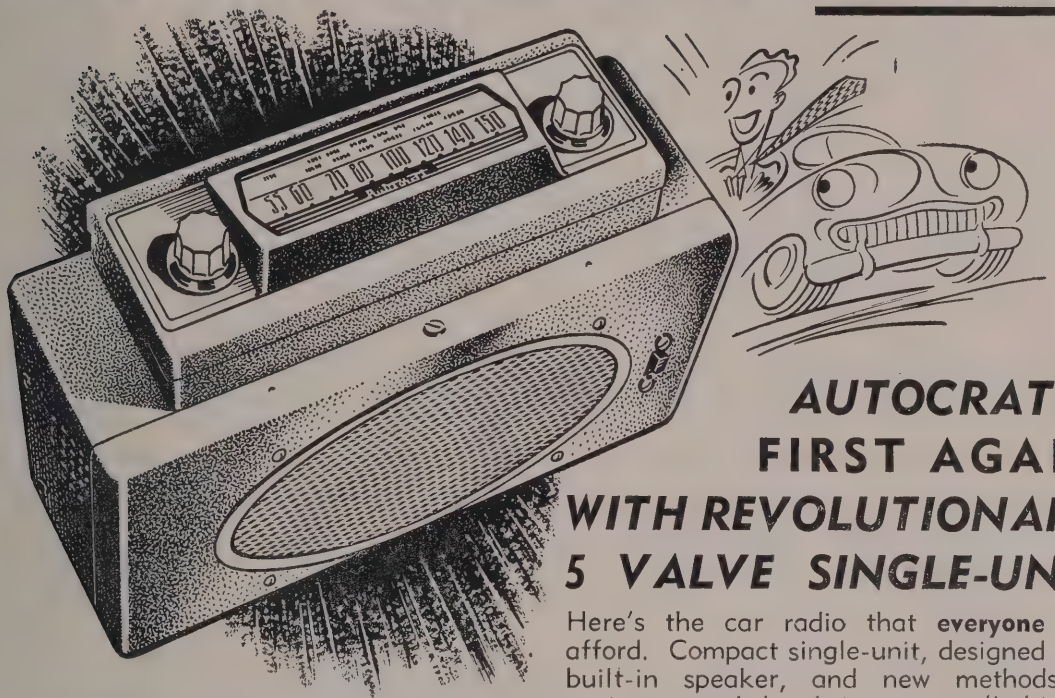

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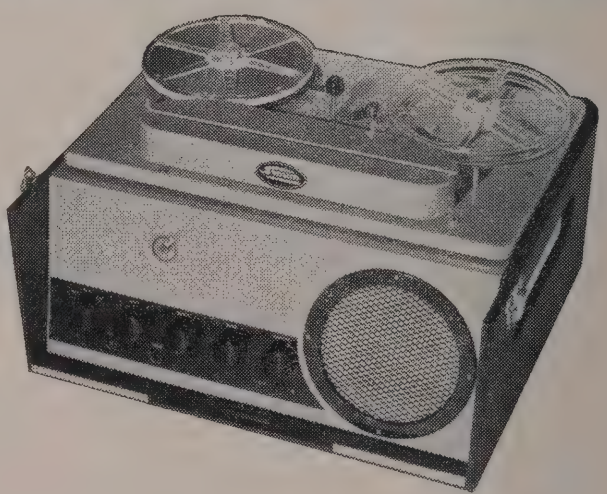

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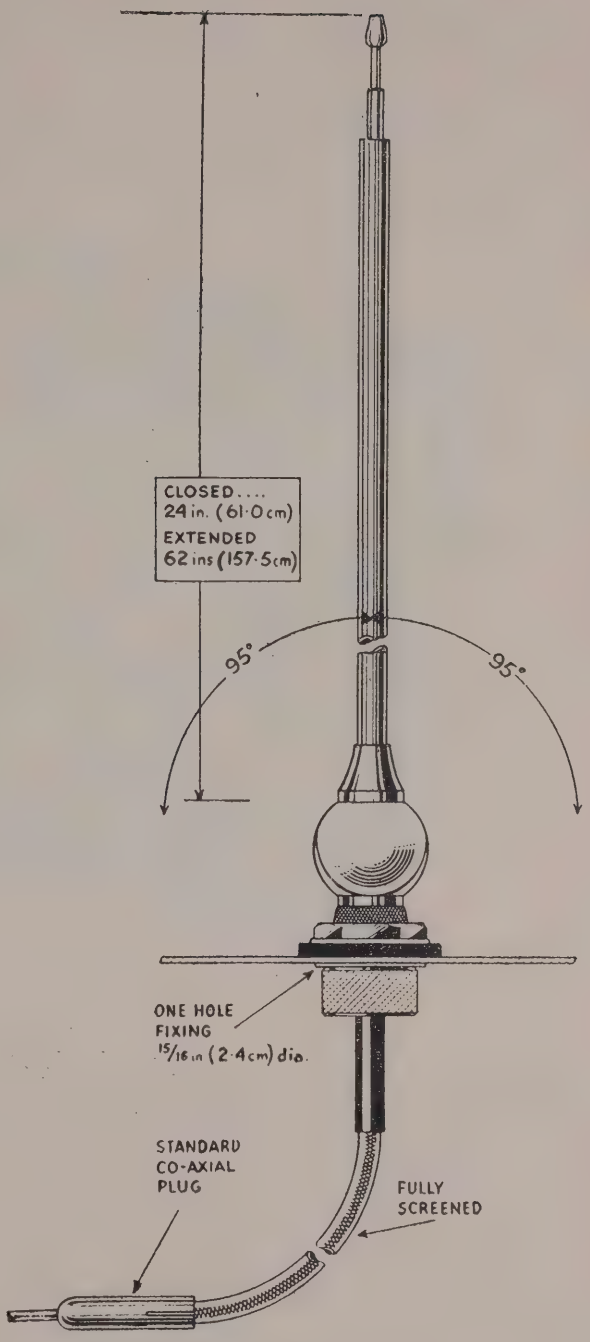

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To be Published Shortly

In a digested form, this 96-page book contains basic constructional data on all the equipment described in "Radio and Electronics" and its successor, "Radio and Electrical Review," from February, 1951, to June, 1954, inc. As with the two previous Digests, the scope of this book is extremely wide, ranging from the simplest to the most advanced radio sets, amplifiers, test gear, etc. All essential data are given, together with references to the original descriptive articles which appeared in "Radio and Electronics."

NOTE: None of the material in "Digest No. 3" has appeared in the two previous Digests.

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Sound Effects In Public

Many of our readers outside of Wellington will be interested to hear how the "R. & E." demonstrations of high-quality sound reproduction went off—whether, for instance, the effort to obtain good results in a hall, rather than in a small living-room, was a dismal flop or a resounding success, and what, if anything, we have learned from making the attempt. It is inevitable that our own efforts should be compared, on a small scale, with those of Mr. G. A. Briggs in the Royal Festival Hall, in London, and it has been most illuminating to compare notes with him, if only in a one-sided manner, through reading his own article in the March issue of "Gramophone."

In the first place, the lecture hall in which our own demonstrations were given seats roughly 110 people, as against the 3,000 seated by the R.F.H. Secondly, acoustic treatment in our hall is nil, the walls being of wood panelling and the ceiling of plaster. The Festival Hall, on the other hand, was designed to have particular acoustic properties—in particular, to possess the utmost clarity. Now, the latter depends on strict control of reverberation, and it is worthy of note that, during Mr. Briggs's rehearsals, when the hall was empty, some records actually sounded better than when the audience was present. In our own case, the reverberation was such that no possible judgment could be made in the empty hall, almost everything sounding quite impossible. With the audience acting as sound-absorbers, however, the acoustics of the place were quite good, and excellent sound was produced by the assorted collection of equipment which had been assembled for the purpose.

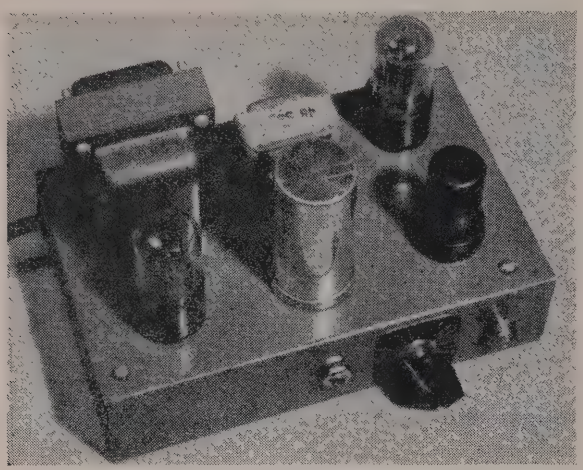
Taking into account the tremendous disparity in the two sets of conditions, it is perhaps surprising to find that at least two of Mr. Briggs's findings were confirmed by our own. First, records made in "live" studios, and thus with their own reverberation or studio "coloration," are quite impossible to reproduce well in a hall which is itself a live one. In the extreme case of the empty, very reverberant hall, it was found that only one recording we possessed sounded well. It was the "Dance of the Hours," cut on the well-known Nixa demonstration record. This particular cut is one of the deadest recordings it has been our fortune to meet, and, in a normally furnished living-room, it sounds "stale, flat, and unprofitable," but, played in the empty hall, it was remarkable, with just the right amount of reverberation to make it live!

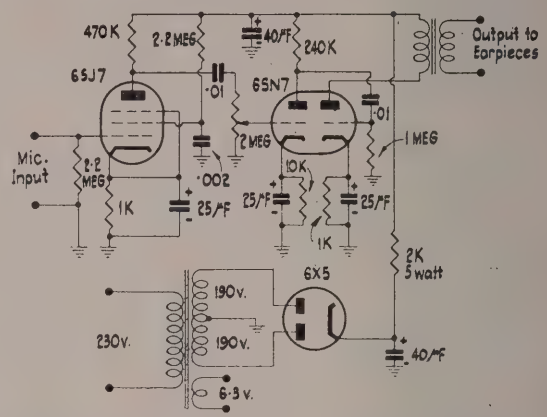
Like Mr. Briggs, we, too, found that the surface noise from even good shellac 78 r.p.m. discs was insupportable. He puts this down partly to the fact that, for a hall of his size, considerable audio power had to be used, thus emphasizing the scratch in quiet passages of music. To us, this hardly seems a valid reason. In our small hall, and possibly in the R.F.H., a better explanation would seem to be that when reflection of high-frequency sound does occur (and especially the random noise type of sound made by record scratch), its random nature causes its effect to add in a way that does not occur with coherent musical sounds. There is no reason to suppose that the audible effects of reverberation on such widely different kinds of sound should be similar.

Another matter in which our experience tallies with that of Mr. Briggs is that of audio power required. It came as rather a surprise to many of those present to find that even such sounds as heavily played tympani,and huge gongs, as found on one of the special demonstration records used, could be quite adequately handled by an amplifier rated at six watts maximum output. In the Festival Hall, Mr. Briggs's full output of 60 watts was required only once—in producing the extremely powerful tones of the organ during the playing of a Bach toccata. In the R.F.H., a peak power of 10watts was sufficient to fill the hall from a high-quality record of a dance orchestra. In his account, Mr. Briggs gives figures for the power needed in the home to produce the same impression of loudness, on the same records as were used in the R.F.H., and comes to the conclusion that the maximum possible power requirement is 10 watts peak. We could go even further, and say that wholly acceptable results can be produced in the home from only half this amount of power. Of course, speaker efficiency comes into the picture, and, under some conditions, a good deal more power could well be a necessity.

Audio

AN AMPLIFIER FOR HEARING-AID APPLICATIONS





Circuit of the amplifier. The output transformer should match 20,000 ohms to 4 ohms, and a standard 3-watt multi-match can be used for the purpose. No special components are needed.

INTRODUCTION

Most often, when audio amplifiers are mentioned, the question is how much, and not how little, power can be obtained, but here is an audio application where the total power output is required to be only a few milliwatts, and where several watts would be an embarrassment. This is the situation when it is proposed to feed a number of headphones in a church or theatre for the use of those who need some assistance for their hearing. It might be thought that anyone who normally uses a hearing-aid would be adequately served merely by turning it on, but such is not the case. The difficulty is that the microphone of a hearing aid, being in the same position as its wearer, is too far away from the speaker. Reverberation in the auditorium and reflections from its walls cause the microphone to pick up a jumble of sound, which is then amplified and presented to the listener without modification. It then becomes almost impossible for him to understand what is being said, however great the volume at his ear. Anyone with normal hearing who doubts the truth of this statement should try it for himself by borrowing a hearing-aid and taking it to a picture theatre or, better still, to a hall or church, where the acoustics are likely to be much poorer.

The only way out of the difficulty is to place a microphone near the speaker and to give the partially deaf listener a headphone. The sound he receives is then unimpaired by reflections and is thus perfectly intelligible. Many churches have had systems of this sort in operation for a long time, but the problem is one which those who are known to have some knowledge of audio work are likely to be called upon to solve at any time. There are no great difficulties to be overcome once the nature of the problem is appreciated, but without a knowledge of the exact requirements there are several traps into which the unwary could fall.

REQUIREMENTS FOR OPERATING HEADPHONES

Perhaps the first question that must be answered is, how much audio power is needed to make a sufficiently loud noise in a headphone? For most applications, the standard power allowed for a pair of headphones is 6 milliwatts. It is at this figure, for instance, that receivers intended for headphone operation are measured for sensitivity, and tests show that 6 milliwatts into any reasonably sensitive headphone represents more than comfortable volume to a person with normal hearing. In the design of this amplifier, we have assumed that a power of 12 milliwatts into each earpiece (each listener being provided with a single earpiece rather than a pair of headphones) should be sufficient for those with defective hearing.

The amplifier illustrated in this article was arranged to handle up to twelve earpieces, and thus to be suitable for a small church. This means that a maximum power output of approximately 150 milliwatts is all that is required. It can now be seen that an ordinary audio amplifier, with a single pentode output stage and a power output of some 4½ watts, is much larger than is needed. Such an amplifier would use a larger power supply than the job really requires, would use more components, and would be more costly than necessary. In addition, the special requirements of the amplifier are such that a pentode amplifier is quite unsuitable unless it is provided with heavy negative feedback.

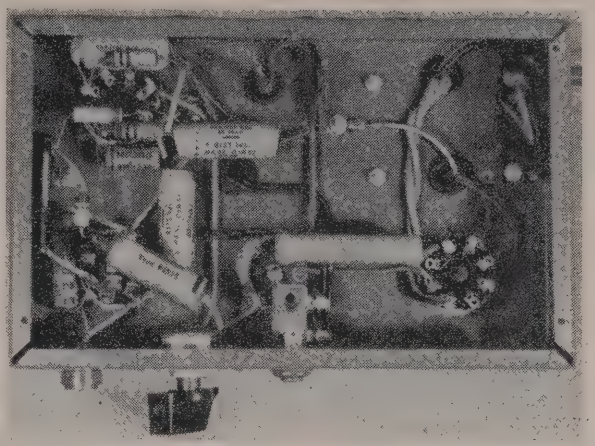
UNUSUAL REQUIREMENTS

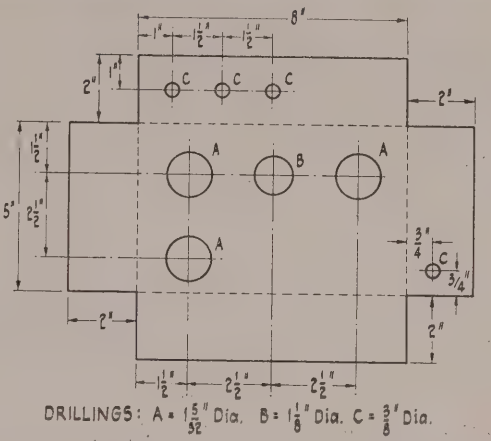
Apart from the small output power, an amplifier of this sort has one rather special property if it is to be entirely satisfactory. It must obviously have enough power output to operate the maximum expected number of earpieces, but it must also be able to operate satisfactorily if only one of these is in

use at a time. One thing that must not happen, for instance, is for the volume to decrease in the headphones in use when additional phones are turned on. Similarly, when the users adjust the volume in their respective earpieces, there must be no effect on the volume in the remaining ones.

In the present case, for example, the amplifier has to supply any number of earpieces from one to twelve. This means that the load impedance presented to the amplifier can vary over a range of twelve to one. Now, most ordinary amplifiers are designed for a load of fixed value. Take, for example, the case of one feeding a loudspeaker. The nominal impedance of the speaker is known, and matching between the speaker and the amplifier is arranged by using an output transformer with a suitable turns ratio. But what are we to do in a case like this one? Supposing the headphones have an impedance of 50 ohms each. If we were organizing the amplifier to feed only one, we would simply make the output transformer ratio suitable for matching the plate load resistance of the output valve to 50 ohms, and that would be that. If we are going to have a 50-ohm load at one time, and by paralleling the earpieces, a load of 4.2 ohms at another, what ratio are we to make the output transformer? Common sense might suggest making the matching suitable for something in between these values, but in this case common sense, unaided by science, would be wrong. Instead, we can make use of a known fact about triode valves. It is this: There is a value of load resistance at which a triode will give maximum undistorted output power. Above and below this value the power obtainable drops off, but (and here is the important point) this reduction is very much smaller for load resistances higher than the optimum than it is for loads lower than this. Thus, if we match the amplifier so that it gives its greatest power output into a load of 4 ohms, we can feed the whole 12 earpieces with 12 milliwatts each, or we can, if we wish, feed all the available output into one earpiece. In practice, we are unlikely to want to do this, but it is a useful facility nevertheless. More important is the action of a low-impedance triode valve as a constant-output-voltage device. That is to say, if we adjust the volume level to be correct for one earpiece, and then several others are switched into use, we will find that the change in voltage across the earpieces is negligible. In other words, the amplifier automatically provides more output power to supply each additional headphone as it is switched into circuit, and the voltage across each remains almost unchanged. If the voltage across them is the same at all times, this means that the power each receives is also the same, and independent of how many are in use.

This is exactly the sort of behaviour that is required, and it can be obtained either by using a triode output tube, without feedback, or a pentode or tetrode with feedback. Since there is no necessity in this application to use feedback for the purpose of reducing distortion, much the simpler scheme is to use a triode. And because the maximum power output is so small, one-half of a 6SN7 is quite large enough for the job. When we set out to design the amplifier, we thought it might be necessary to use the output valve as a cathode-follower, because this circuit is much more effective as a constant-voltage device than the conventional one in which the load is placed in the plate circuit. However, the self-regulating property of the ordinary circuit was found to be adequate and





Above: Under-chassis view of the amplifier; and Below: Working drawing for the chassis.

was used because it provides about 20 times as much voltage amplification as does the cathode follower, whose voltage gain is slightly less than unity.

MICROPHONE PRE-AMPLIFICATION

Having settled the form of the output stage, the rest of the circuit presented no difficulty at all. It remained only to decide what kind of microphone was most suitable for the application in hand and to incorporate enough voltage amplification to suit it.

Perhaps the best choice for the microphone is a modern diaphragm crystal. These microphones have a relatively large output, are robust, and have the advantage of being substantially non-directional. In a church, the microphone should preferably pick up not only the preacher's voice, but also the organ and choir, for the user of the hearing aid wants to hear everything that goes on. When a church service is broadcast, it is standard practice to use two microphones—one at the pulpit and the other strategically placed so as to pick up the choir and organ. Such a system requires that someone should be in control of the microphones, so that the choir microphone can be turned off when the preacher is speaking and the pulpit one can be turned off when the other is

in use. If this is not done, the mixed output of the two produces an artificial echo which is much worse than any due simply to the acoustics of the building.

However, such a scheme would be quite impracticable for a hearing-aid system, so that one microphone must be made to do the job. Under these circumstances, a simple non-directional microphone will give the best all-round results, although there must be instances in which a directional instrument might possibly be an advantage. Unfortunately, all such microphones have very low levels of output, and so would require a great deal of pre-amplification. This would complicate the system rather more than would appear at first sight, for the extremely high over-all gain needed would introduce certain difficulties, such as a need for a very low hum level. Since the system is intended mainly for speech, and also is intended for partially deaf persons whose hearing is most often worst at the higher audio frequencies, there is a good case for an over-all frequency response which falls off fairly rapidly at low frequencies and is either flat or has a slightly rising characteristic at high frequencies. No question of "tailoring" the frequency response to a particular curve occurs, however, because, although this is always done with individual hearing-aids, a system like this one has to be as suitable as possible for anyone who might wish to use it. The reproduction of speech is particularly crisp and intelligible, owing both to the use of a crystal microphone and to the use of a low-frequency roll-off in the amplifier. At the same time, this has not been made so steep as to give the reproduction a raspy or tinny sound.

Since only one-half of the 6SN7 is used as the output valve, the other half is available for use as a voltage amplifier. With a load resistor of 220k., this stage has a voltage gain of approximately 14 times. The output tube required an input signal of 8 volts peak for full output, so that at the grid of the voltage amplifier section of the 6SN7 the signal needed is 0.57 volts peak. It is obvious that at least one more stage of amplification will be needed if the amplifier is to operate from a crystal microphone, and so a 6SJ7 was chosen for the pre-amplifier valve. With a 470k. load, the gain of this stage is approximately 200 times. This means that a signal from the microphone of 0.0029 volts, or 2.9 millivolts peak, will fully load the amplifier. This is more than adequate sensitivity, so that we need search no further.

THE CIRCUIT IN DETAIL

Once the general design of the amplifier has been settled, the detailed circuit can be worked out, and, as the diagram shows, it is quite ordinary looking. The output stage uses a conventional output transformer, which is one intended to match any valve load to any voice-coil impedance. It is, in fact, a standard 3-watt universal output transformer, and the connections are made so as to match 20,000 ohms to a voice-coil impedance of 5½ ohms. To obtain this, the whole primary winding is used, and the output is taken from secondary terminals Nos. 5 and 6. This matching was found by experiment to give the best results under the conditions discussed earlier in this article.

The roll-off at low frequencies mentioned earlier has been brought about by making the coupling condensers somewhat smaller than usual, but not very much so. We mention this because, if the 0.01 μf. coupling condensers were replaced by the more usual 0.05 μf., the result would be rather too much response below 100 c/sec., and this would cause undesired noises to be somewhat too strongly reproduced, tending to mask the speech and making the result tiring to listen to.

The microphone is worked into a load of 2.2 megohms. This again helps to reduce the low-frequency response slightly and to reduce the hum which might be picked up by what is, after all, a high-gain amplifier.

The power supply for such a small amplifier needs to be very small, and this reduces considerably the expense of building it. The power transformer is rated at 30 ma., and gives 190 volts each side of the centre-tap, for a 6X5 rectifier. The amplifier draws no more than about 8 ma., so that the transformer runs very cool, and the rectifier is delivering only a small fraction of its rated output. Under these conditions, the life of the power supply components should be excellent, and replacement and servicing should be almost nil over a period of years. This is quite an important point in anything which is designed for use in a public building, because any electronic gear which is installed is expected to work, year in and year out, without any attention.

With such a small H.T. requirement, smoothing is no problem at all. A resistor may be used in place of a choke, and with the two 40 μf. condensers (a dual 40 μf. was used) the hum level is quite inaudible in the headphones.

LAY-OUT AND CONSTRUCTION

There is really only one point to watch in constructing the amplifier, and that is to see that the pre-amplifier valve is as far away from the power supply components as possible and that, especially in the earlier part of the circuit, there are no long leads which can pick up hum. The chassis diagram shows a suitable lay-out, from which there is little point in departing. From this and the photographs, it will be seen that the power supply components occupy the left-hand side of the chassis, except for the dual smoothing condenser unit, which is in the middle at the front. The amplifier valves occupy the right-hand side of the chassis, thus complying with the requirement mentioned above. The input socket, at the extreme right of the front of the chassis, is very close to the grid terminal of the 6SJ7, and the gain control, which is next to it, has shielded leads both from the 6SJ7 socket and to the 6SN7 input grid. The output of the amplifier (i.e., the secondary of the output transformer) is wired to a phone jack, also on the front of the chassis, as the unit was intended for mounting on a wall. Incidentally, it is a good idea to use different sorts of connector for the output and input, as this often saves a deal of head-scratching if the wrong plugs can be put in the sockets!

GREATER POWER OUTPUT

If the rather minute power of this amplifier is not sufficient for an application that anyone might have in mind, it would not be difficult to modify the design to give greater power. One way would be to use both halves of a 6SN7 in parallel as the output stage, providing a separate 6J5 or 6C5 to replace the triode voltage amplifier section of the existing 6SN7. The output matching would then have to be altered so as

(Concluded on page 53.)

A PHOTO-ELECTRIC WARNING DEVICE

Most of those interested in electronic gadgetry have read of photo-electric devices which perform some operation when a beam of light is interrupted, but have seldom thought of building or using one. Here is a simple and inexpensive arrangement which could be used for a wide variety of purposes.

INTRODUCTION

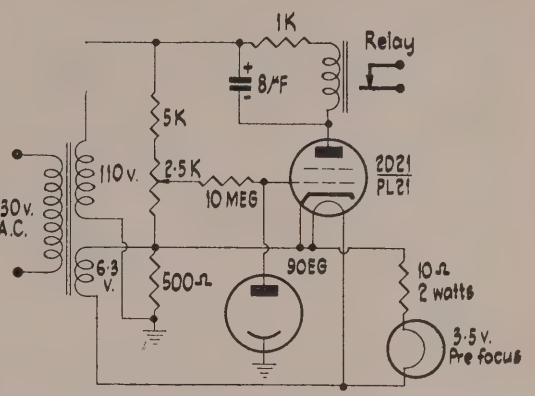
It is several years now since the application of photo-electric cells first became commonplace; initially, these were regarded as something of a wonder, as is anything which works from infinitesimal amounts of energy, and it was not long before such cells were put to use in industry, especially in technologically advanced countries like the United States of America. It has always been a source of wonder to us that more use is not made of photo-electric relays, counters, and the like than appears to be the case. Their use in alarm arrangements, or for automatically performing such operations as counting, door-opening, and so on, seems to be far less widespread than it could be. Perhaps one reason for this is to be found in the fact that, for a long time, the cells themselves were quite costly, but such is hardly the case today. Perhaps the major application of photo-cells is in sound projectors, where the cell is used to convert the sound track on the film into audio voltages which can be amplified and used in a loudspeaker system, but there is a host of other applications which do not require complicated or costly auxiliary equipment. These uses are to be found not only in shops, offices, or factories, but also in the home, and given a device which operates an electric relay when a beam of light is either received or interrupted, there is hardly any limit to the number of uses that can be found for it, other than the imagination of the user.

THE PRESENT EQUIPMENT

The small piece of equipment described in this article was built to do a specific job, but it can hardly be said to be specialized on that account. Basically, it is nothing more than a light-operated relay, in which the relay operates when the light falling on a photo-cell is interrupted. The closing of the relay can be used to initiate any action that might be imagined, from ticking up another number on a counting mechanism, to opening garage doors, or ringing a warning bell.

Only two valves are used, one being the photo-cell itself and the other a miniature gas-tube, or thyratron, which acts as the relay valve. The power supply is exceedingly simple, as the whole circuit is operated on A.C., thus saving the cost of a rectifier and smoothing system. Indeed, with the circuit used, A.C. on the relay valve is essential, otherwise, once the valve was caused to conduct, it could not become non-conducting again, except through some manual agency. The supply for the photo-cell is also A.C., but this makes no difference to its operation.

The cell used has the type number 90CG, and is one which is currently available at a reasonable price. It is of the photo-emissive type, which acts much in the same manner as an ordinary diode, with only one exception. The cell has only two electrodes, called the anode and the cathode, and in normal operation a positive potential is applied to the anode. A better way of describing it would be to say that the anode is made positive with respect to the cathode. In describing photo-cells, the anode is never called the **Plate,** because of the possible confusion that this would cause.



Circuit diagram. The relay can be any one which will pull in on 50 ma. or less. The 1k. resistor in series is to limit the current through the thyratron to a safe value. The maximum allowable current for this tube is 100 ma. The screen grid connection, which has been omitted from the diagram, should be made direct to the cathode. The printing block has failed to reproduce the connection between the upper end of the 110v. winding and the horizontal lead at the top of the diagram.

The anode of a photo-cell is a single wire, placed in front of the cathode, which is a portion of a cylindrical surface, coated on the side nearest the anode with photo-emissive material. This has the property of emitting electrons only when illuminated, and, over a wide range of light intensity, the number of electrons emitted is proportional to the quantity of light falling on the cathode. In the dark, practically no electrons are emitted. Thus, when the anode is made positive with respect to the cathode, the emitted electrons are attracted towards the anode, and current flows. If now a load resistor is inserted between the source of positive voltage and the anode, changes in light received by the cathode cause changes in current through the cell, and these in turn bring about changes of voltage drop across the load resistor. The latter can be made quite large without any ill effects—ten megohms is quite common—so that, although the electron emission is only of the order of a few microamps, the voltage drop across the load resistor can be several volts. Thus it is that for applications in which only on/off operation is needed, very little amplification has to be used, following the photo-cell itself. If there is a direct connection between the anode of the photo-cell and the grid of an amplifier tube, very small light changes suffice to cause current changes in the amplifier valve of several tens of milliamps. The amplifier valve can therefore

work a relay connected in its plate circuit, so that the single-valve D.C. amplifier acts at the same time as the relay valve.

The above description applies exactly to the circuit used here, with the exception of only one point—namely, the use of alternating voltages on both the photo-cell and the amplifier tube. Fortunately, this makes no difference at all to the principle of operation and those who may have difficulty in imagining the circuit action under these conditions can just as easily pretend that all the electrode voltages are direct ones. Neither the photo-cell nor the amplifier valve will function when their anodes are negative with respect to their cathodes, so that, when the negative half-cycle of the alternating voltage comes along, the circuit is quiescent. During the positive half-cycles, the circuit works, and the currents which flow depend on the peak value of the alternating voltage, just as they would depend on the D.C. voltages were they used instead. The fact that the photo-cell and valve currents are interrupted altogether once every fiftieth of a second does not matter at all, except that, if the relay is a fast-acting one, it will try and follow the short on-off periods and would chatter. This is easily prevented by connecting an electrolytic condenser across the relay. The condenser charges up during the conducting period and, during the negative half-cycles, discharges into the relay coil, thus keeping the current going continuously in spite of the alternating plate voltage.

ACTION OF THE CIRCUIT

The best place to start in explaining the action of the circuit is the voltage divided chain connected across the A.C. supply winding. About one-sixteenth of the way up from the earthy end is connected the cathode of the thyratron. Farther up than this, at a point determined by the setting of the potentiometer, is the point from which the grid of the thyratron and the anode of the photo-cell are fed. This point on the circuit is not connected directly to the potentiometer tap, however, but through a 10-meg. resistor which forms the load resistor for the photo-cell. Thus, when the latter is in darkness, no current flows through the 10-meg. resistor, and the grid is at the same potential as the tapping point. The values are such that when this occurs the thyratron fires on the positive half-cycles of the alternating voltage. Firing is assured because, when the circuit is in this condition, the alternating voltage on the thyratron grid is in phase with that on the plate. This means that when the plate voltage swings positive, so does the grid voltage, and, this being the case, the grid voltage is able to trigger the tube into conduction. On the negative half-cycle, the plate voltage swings negative with respect to the cathode, so that the tube de-ionizes and goes out. On the next positive half-cycle, however, it fires again, so that a continuous succession of plate current pulses, at the rate of the supply frequency, which is 50 c/sec., flows through the thyratron and therefore through the relay. Provided the average current through the tube is large enough, the relay comes in and stays in as long as light is kept from the photo-cell.

When light falls on the photo-cell, however, this draws its few micro-amps of anode current, which flows through the load resistor, taking the grid of the relay valve to beyond cut-off. Under these conditions, the valve is unable to conduct, even when the plate is positive, and so the relay drops out. With this simplified explanation in mind, the purpose of the 2.5k. potentiometer can now be explained. First of all, the moving arm provides the supply voltage for the photo-cell. If the arm of the potentiometer is at the earthy end of its travel, there is no operating potential applied to the cell, so that, under this condition, nothing can be expected to function. As the slider is raised towards the high-potential side of the A.C. supply, the operating voltage on the P.E. cell is increased. At the same time, however, the potential of the thyratron grid is raised, so that, when the cell is darkened, the relay tube is certain to conduct and pull in the relay. Now, for strong illumination, the current through the cell is increased, so that the relay tube is very firmly cut off. If now the illumination is decreased, as when the beam is partially interrupted, the cell current decreases, and the relay operates. Supposing, however, that the distance between the light source and the apparatus is increased, the maximum light level is permanently decreased, even without the beam being cut, so that the relay would pull in permanently and would thus cease to fulfil its purpose. This can be overcome by turning the control so as to decrease the voltage on the photo-cell, and therefore the potential on the thyratron grid. Eventually, a point is reached at which the relay tube ceases to conduct, because by this adjustment we are not allowing the grid to go so far positive on the positive half-cycles of the supply. This having been done, the device will once more function when the beam is totally or partially extinguished. Finally a limit is reached, below which the light falling on the P.E. cell is too small in quantity to take the thyratron grid to cut off and drop the relay out.

Fortunately, the sensitivity is adequate for most purposes, even with a very small source of light. For distances where the light beam has to travel up to fifteen feet or so, a light source consisting of a 3.5v. pre-focus torch lamp, in its reflector, is strong enough. Much greater distances could be covered by increasing the intensity of the light, and this can be left to the individual user.

OPERATING THE PHOTO-ELECTRIC RELAY

By way of illustration, we can cite the use of the device as an electronic shopminder. The prototype has been installed so as to throw a beam across the entrance to a shop so that anyone entering cuts the beam and operates a warning device, indicating to the owner, who is often in the workroom at the back of the shop, that someone is there and requires attention. From the operational point of view, even a simple application like this has one or two points about it that could easily constitute "snags" had they not been thought out in advance.. The first of these is the penchant of many people for standing just inside a shop entrance while either looking in the window or merely sheltering from the rain. Such people frequently have no intention of actually entering the shop to make a purchase, so that if the device recorded their presence, everyone's time would be wasted. The cure for this is not to install the light beam right across the door-jamb, but to place it several feet inside the door, so that the warning will not sound unless someone comes right into the shop and really does require attention. Another point arises here. If the door is kept closed, with perhaps a sign on it inviting the public to "please enter," the beam must be far enough behind the door not to be

interrupted by the door itself when this is opened. Otherwise, when the door is left permanently open, the warning device will be out of action.

Another thing that must be remembered is that the relay closes while **and only while,** the light beam remains interrupted. Now, suppose the relay has been arranged to close the contacts of an ordinary electric bell circuit. The circuit will remain closed and the bell will ring only so long as the beam is cut. This period is only very short, for it takes only a fraction of a second to walk through a beam of light. It is questionable whether the ringing period would always be long enough to draw the attention, unless the bell were a very loud one. A way out of this difficulty would be to arrange a "hold" circuit, which would keep the relay in permanently once the photo-electric cell had closed it. This system would have the disadvantage of needing to be turned off manually every time the bell rang, and this could be a very real nuisance. In addition, a holding circuit might be difficult to arrange with a thyratron-operated relay.

In the present instance, the problem was solved rather elegantly by making the device operate a conventional door-chime of the kind that hits one gong when the button is pressed and a second one as it is released. Thus, when operated from the photo-electric relay, the double chime is produced, one note coming when the beam is interrupted and the other when it is restored. Further, should anyone stand in the beam for any length of time, all that happens is that the first chime sounds, after which there is silence. If an ordinary electric bell were used, it would ring as long as the beam was cut.

LOCATION OF THE EQUIPMENT

The obvious way of arranging the equipment is to have the photo-cell and relay unit on one side of the door and the lamp on the other. It is more convenient, however, to have all the equipment on the same side of the door, as this will enable the lamp and photo-cell to be placed on the same chassis. Then there is only one piece of equipment to be installed instead of two. It can be done by placing a mirror on the other side of the door. The beam is then directed at the mirror and reflected back along almost the same path, to arrive on the photo-cell. The only disadvantage of this scheme is that the distance over which the light has to travel is doubled. For short throws, this will have no effect on the operation, but for longer ones it might mean that an increase in lamp power is required. The sensitivity is so high, however, that this cannot cause the slightest difficulty. It is only in cases where the throw is a hundred feet or more that a very powerful light source would be essential, so that for all simple jobs the set-up is quite satisfactory as it is, and for more difficult ones, experimenting to find a suitable light source is not difficult in any case.

LETTER TO THE EDITOR

A READER'S EXPERIENCE WITH THE SYNCHRODYNE

Sir.—Building my synchrodyne receiver took me some time and cost me some money, but the results have been so worth-while now I have it working well that I have no trouble believing the performance figures you quoted.

My first problem was achieving stability, partly because I forgot the drift of mica trimmers. Substituting air trimmers in the oscillator improved the stability, but to keep the oscillator stable for a month I have had to add a couple of feet to the aerial, formerly about four feet long. If possible, wire a negative temperature coefficient condenser of a few picofarads value across the oscillator coil. Mount the coil where it is well ventilated, and this applies to other oscillator components.

My receiver uses EF91s instead of EF50s. Consequent modifications to the circuit are to connect the screens of the two R.F. tubes direct to H.T., and alter the cathode resistors to 250 ohms for the first tube (R.F.) and 600 ohms for the second. However, there is no noticeable degradation in performance in retaining the original values with EF91s. I mounted a perforated metal box over the whole oscillator section instead of screening the tube individually, which assisted improving stability. It is advisable to drill holes in the chassis around the tube socket when EF50s are used, to ventilate the oscillator.

I cannot claim to have devised these modifications myself, the originator preferring anonymity. However, in my personal experience, I find the signal strengths of the five Wellington stations are very different from one another. If I re-built my receiver, I would have another switch wafer to switch different lengths of aerial or different values of attenuation into the aerial, to achieve constant output level. Probably then the third wafer, for locking voltage, could be done away with, and one value of locking voltage serve all desired transmitters.

A problem in Wellington which may occur similarly in other centres is the possibility of leakage of the Mt. Victoria transmitters into the receiver channels of the Titahi Bay stations (and vice versa in the Hutt). I have not tried a faraday screen between windings of the detector coil, but suggest it as a possible cure. I have not had to modify my receiver, as leakage of 2YX on to the channels of the Titahi Bay stations has been so small as to be barely noticeable, but I have heard that others have found this objectionable in their receivers. Another possible cure is to feed a push/pull audio stage from the detector and balance out the interference by tapping down the grid leak of one.

The several constructors I know who have built the synchrodyne have had to reduce the loop turns on the oscillator coil from six turns to four to make the oscillator oscillate when coupled to the detector. This was my experience also.

I know of two cases where even reducing the loop winding on the oscillator coil to four turns (or less) did not induce oscillation. The point here is that the loop winding must be physically at the earthy side of the primary (cf. transmitter single-layer coils). In a bunched winding, therefore, on this former, the start of the primary connects to the EF50 screen, the

(Continued on page 43.)

HIGH-QUALITY SOUND REPRODUCTION

AN APPRECIATION OF THE "R. & E." LECTURE COURSE

By B.D.

"High fidelity" or "audio" fever is spreading rapidly in New Zealand. No cures have been recorded. Given proper care, the patient will come to no harm beyond experiencing a recurrent sense of restlessness and dissatisfaction, usually more than compensated for by periods of elation. In this respect, the condition resembles a mild drug addiction. Untreated, it may lead to a vast accumulation of expensive, discarded equipment and, ultimately, bankruptcy. Noticeable among early symptoms is a sense of unco-ordination and bewilderment, aggravated by avid reading of rival manufacturers' claims and by contradictory advice, sprinkled with indigestible technicalities, administered by well-meaning acquaintances. Recommended minimum treatment is for the patient to find, if he can, one well-qualified expert and submit to his guidance. This, however, will not completely satisfy the typical addict. He will, quite properly, want to know something of "why" as well as "how."

For people of this sort, Mr. W. D. Foster last month gave a course of three lectures on "High-quality Sound Reproduction." As editor of "The Radio and Electrical Review," Mr. Foster usually addresses an audience with at least some technical qualifications. This time, however, his lectures were designed to meet the needs of those who don't know an ohm from a cathode bypass but want to acquire equipment which will reproduce music as well as possible, or at least considerably better than the handsomely veneered cocktail cabinet that commonly goes under the name of radiogram.

The first lecture was given on Saturday, May 14, and attracted an audience most of whom arrived a good 20 minutes before starting time and filled all but half a dozen of the front seats in the hall of the Wellington Public Library. It was an attentive audience, and, judging by comments heard afterwards, thoroughly appreciative. For some, at least, it was obviously a first and enlightening experience of listening to a reproducing system consisting throughout of high-quality components, properly matched.

Mr. Foster set out to impart an understanding of fundamental principles. He dealt in simple terms, but adequately, with the nature of sound, the transmission and re-creation of sound vibrations, the important properties of musical tones, the properties of music and non-musical sounds, and the requirements of good reproduction.

Even for those with enough technical knowledge to qualify in the home-constructor class, Mr. Foster's lucid exposition of the elements of the physics of sound must have been rewarding. To those coming quite fresh to the subject, it gave a sound basis of knowledge on which to build.

Equipment used included a very good, but very expensive, American speaker system which few in New Zealand, outside professional sound engineers, have previously had an opportunity of hearing. Some excellent high-fidelity records, also not readily available here, were used for demonstration purposes.

A direct comparison between selected passages played through an ordinary domestic radio and then through the high-fidelity equipment was illuminating. The commercial radio, as Mr. Foster said, sounded pretty good, surprisingly good, till one heard how very much better the same record could sound when given the full high-fidelity treatment. It was only then that one realized how much had been missing before. The solid bass, the shimmering strings, and the crisp percussion which, coming from the big demonstration outfit, satisfyingly filled the hall, were, it was seen, reduced to mere shadows by the domestic set.

The equipment used at the first lecture was not named from the platform, but, snooping about beforehand, I saw a Connoisseur turntable and what looked like a Gray arm of the viscous damped type. In it was a Ronette cartridge with diamond stylus. The amplifier, I found by inquiry, was a modestly powered 6-watt job, designed and built in the laboratory of Radio and Electronics Ltd. and described in "The Radio and Electrical Review" of June and July, 1954. The speaker was an R.C.A. dual concentric, LCIA, in R.C.A.'s own bass reflex cabinet.

To meet the printer's deadline, this notice is being written before the second and third lectures have been given. Mr. Foster has promised to deal with the shortcomings of ordinary equipment, to describe the essential components of a good reproducing system and its method of operation, and to discuss what he calls "the economic problem." By that, I imagine he means, "How to get the sound you want and still have a roof left over your head." Various types of pick-ups, amplifiers, speakers, and enclosures will be demonstrated, and the synchrodyne tuner, now regarded as the best for high-quality radio reception, will be heard in operation. Representative types of music will be reproduced from record and tape, and Mr. Foster will answer questions.

Only one thing, it seems, has been overlooked: Wives, and how to convince them that an outfit costing a lot of money and many hours of research and capable of producing 30 to 15,000 cycles, level, without distortion (well, almost!) should not be referred to as "the wireless" and lightly turned down to provide a background for conversation. It was interesting to note that at the first lecture only four or five men were accompanied by women. If there are any more of these lectures, and one hopes that there will be, it might be a good idea for a man to let his wife see that he is not alone and peculiar in his passion for a "wireless" involving, it must be admitted, quite a lot of wires and perhaps even bricks in one corner of the living-room.

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The Editor's Opinion

A NEW ELECTROSTATIC LOUDSPEAKER

A NEW ELECTROSTATIC LOUDSPEAKER

The announcement that a new piece of equipment has hit the New Zealand market is always of interest, and especially so if the item concerned is an unconventional type of loudspeaker. While there is nothing new in the use of the electrostatic principle for this purpose, commercial examples having appeared off and on for many years, both in America and on the Continent, this unit will certainly find itself alone as the only electrostatic speaker on the New Zealand market.

HIGH FREQUENCIES ONLY

First of all, we should make clear the fact that this is not intended to cover the whole audio range. It is a tweeter, pure and simple, and as such should find many buyers among those enthusiasts who are always looking for ways of improving their outfits.

The unit's first shock for the beholder is its rectangular shape. It consists of a framework, of light, rigid, plastic material, which holds the "works." These consist of a perforated back-plate of metal, bent into an arc of cylindrical surface, if we can use such an expression. This cylindrical plate has stretched over it a very thin plastic diaphragm, which has a thin metallic coating deposited on the side opposite from the metal back-plate. The whole diaphragm is extremely thin, and is tensioned against the curved back-plate, the two components forming a condenser of 0.004 μf. capacity.

To make such a speaker function, it is necessary to apply a direct polarizing voltage between the "plates" in addition to the audio voltage. If this were not done, the diaphragm would be attracted twice in each cycle of the exciting voltage, and so would produce sounds of twice the frequency of the exciting signal. The polarizing voltage prevents this, just as the permanent magnet of a telephone earpiece does. Needless to say, the provision of polarizing voltage need not cause any difficulty in applying such a speaker, and, in this case, the makers have made it easy for us by designing the unit for a polarizing voltage of 250 D.C., and a maximum signal voltage of 150 R.M.S. The former is always available in any receiver or amplifier, while this signal voltage, or something very close to it, is equally easy to find on the primary side of the output transformer.

PERFORMANCE

The performance of the unit is very interesting indeed. It is intended to cover only the range 7,000 to 15,000 c/sec., and its main sphere of usefulness will be in supplementing the high-frequency response of existing speakers. The electrostatic unit would be expected to have a smooth response, with any resonances well damped by the somewhat resilient nature of the plastic diaphragm. One would also expect to find that the fundamental resonance is either above or well below the working frequency range, and thus unable to cause trouble. The maker's response curve shows an almost linear rise in response, amounting only to about 2 decibels, from 8,000 c/sec. to 12,000 c/sec. At this point, the rate of rise increases slightly, arriving at a very broadly resonant peak at approximately 13,500 c/sec. At 15,000 c/sec., the response has fallen to the same level as at 12,000 c/sec. Thus, without any subsidiary resonances, the response is within plus or minus 2 db. from 8,000 to 15,000 c/sec. Below 8,000, there is a gradual roll-off. Now, in writing a report like this, it is not possible for us to verify such matters as the frequency response of loudspeakers, and we can only speculate as to whether the maker's curve is a "smoothed" one or not. Listening tests, however, tend to confirm the evidence of the published curve, in that it is certainly not possible to find any undesirable peaks or holes in the response by listening either to music or to an oscillator swept through the range.

An important characteristic of the speaker, for which we can readily vouch, is its excellent polar distribution. As might be expected, there is no sharp beaming of the output, as occurs with so many cone speakers, although the maker's curves show that the lateral distribution is by no means non-directional. The excellent effect obtained is probably due to the fact that, over a 30-degree angle, there is no falling-off at all, and that at angles farther from the axis than this, the output falls off quite slowly. With the average cone speaker, the beaming of the high frequencies is very pronounced, with a very sharp peak right on the axis. With these units, no such peak occurs, and an interesting feature is that, by grouping them, almost any horizontal distribution pattern could easily be obtained.

APPLICATION

Space prevents us from giving details of the circuitry needed in order to operate these units, but it is quite simple, and will be unlikely to cause any difficulty. There is only one possible complication, and that is in applying them to amplifiers which have large degrees of negative feedback. Perhaps the best solution here would be to use a step-up transformer from the secondary of the output transformer. In this way, there is no danger of unbalancing the push-pul output stage, but it should be remembered that the transformer will not prevent the speaker capacity from being connected into the circuit. However, across the voice-coil winding, the reflected capacity can more easily be coped with. Indeed, the application of these units seems to offer some interesting possibilities, both musically and technically. In addition, their very reasonable price will encourage those who find experimentation the spice of reproduction. One could well afford to use one or two of them in a three-way system comprising a woofer, a middle-range unit, and a tweeter, with a conventional cross-over network between the first two, and the simple type of network that the electrostatic unit needs, fed either directly from the output stage or from a step-up transformer.

In writing about this most interesting device, we find that we have forgotten to mention the makers, or their New Zealand representatives. The speakers are made by the West German firm of Korting, and those interested should communicate with Box 277, Wellington, or with Messrs. Fears, P.O. Box 1243, Wellington.

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For the Amateur

A Broad-band Converter for 6 and 10 Metres: Part 2

R.F. AND MIXER COILS FOR 6 METRES

Before going on to describe the setting up of the circuits of the converter, here are the data for the 6-metre R.F. and mixer coils.

(1) Aerial Coil:

L_1, Aerial winding, 4 turns; and

L_2, Grid winding, 13 turns of 28 S.W.G. enamelled wire, spaced to occupy half an inch. The aerial coil is inter-wound in the middle of the grid winding. The former is ½ in. in diam.

(2) Mixer Grid Coil:

L_3, 12 turns of 28 S.W.G. enamelled wire, spaced to occupy seven-sixteenths of an inch, also on a ½-in. diameter former.

SETTING-UP PROCEDURE

In the first instalment of this article, there was no indication, on the circuit diagram, of which position the oscillator switch is in. In the position drawn, the switch is in the correct position for the 10-metre band. This might have been inferred from the fact that the 100 $\mu\mu$f. condensers are in circuit.

The first thing to do is to set the fixed oscillators to the correct frequencies. This can obviously be done, if desired, before the R.F. of mixer coils have been made. For the 10-metre band, the oscillator should be on a frequency of 19.5 mc/sec. It is not proposed to go into detail about how this should be done, because few of those who wish to build this converter are likely to need such assistance from us. However, if an accurate beat frequency meter is not available, it will be in order, especially at first, to use an absorption wavemeter to set the oscillator close to the desired frequency. Alternatively, a dual-wave set whose calibration on the shortwave range is reasonably accurate can be used for the same purpose. Should a receiver be used, care must be taken that the oscillator is not set to the image frequency. The best way of avoiding this error is to set the dial of the receiver to the frequency, and then to tune the oscillator until a signal is heard. Because of the receiver's image response, two settings of the oscillator will give a signal in the receiver, and the correct one to choose is the lower-frequency one. If the receiver is properly aligned, this one ought to be stronger than the higher one, but, if it is not, do not worry, for commercial receivers do get out of alignment, and this does not alter the fact that the low one is correct.

The next step is to check that the tunable I.F. circuit in the converter does in fact cover a range from 7.5 to 11.5 mc/sec. This is best done in the following way: The mixer coil, L_3, is removed, if present, and a signal on 28 mc/sec. is fed into the mixer grid through a small condenser, say, 10 $\mu\mu$f or so. For this purpose, one can use a signal generator, or the 10-metre output of the frequency-multiplying portion of the station transmitter. The receiver is then tuned to 9.5 mc/sec., and if the receiver calibration and the oscillator and signal frequencies are correct, a signal will appear in the receiver. If the oscillator and signal frequencies are reliably known, then one can tune in the 9.5 mc/sec. beat on the receiver, and ignore its calibration. Here, again, it is important to guard against image reception. This time, however, the signal frequency of 9.5 mc/sec. is fixed, and we are tuning the receiver, so that the correct way of identifying the image from the desired response is to tune the receiver to the **higher** of the two dial settings at which a response is obtained. This point settled, one can tune the 50 $\mu\mu$f condenser of the converter's output circuit, and see if the circuit peaks. It should do, somewhere in the middle of the range of the condenser. Next, the signal is changed to 28, and then to 30 mc/sec. At each frequency the receiver is re-tuned, and finally the converter's output circuit. This procedure will tell whether the latter has the required frequency coverage. Note that the 28 mc/sec. should be received on the set at a dial reading of 8.5 mc/sec., and 30 mc/sec. at 10.5 mc/sec. There should be no difficulty on this band, as the coverage at the output frequency of the converter is only half as wide as when the 6-metre band is in use.

Next, L_3 for the 10-metre band is plugged in, and the signal is applied at a frequency of 29 mc/sec. to the grid of the R.F. amplifier valve. All that has to be done now is to adjust the trimmer on the mixer coil for maximum signal strength, after the signal has been tuned in on the main receiver. The trimmer is then fixed in position permanently. Finally, the aerial coil is plugged in, and with the signal still on 29 mc/sec., it is adjusted. A word of warning is needed here, however; initial adjustment, to see whether the trimmer peaks up on the right frequency, should be done with a 200-ohm resistor connected across the aerial coil.

The R.F. trimmer should then be found to peak at 29 mc/sec. at about half-capacity. If it does, all is well. If not, the inductance should be adjusted until it does. This ensures that whether an unbalanced (co-axial) feeder or a two-wire line is used when the converter is "on the air," there will be no doubt about the tuning being within range of the condenser variation. The point is that either type of feeder can be used without altering the aerial winding, and the exact tuning position will depend on the impedance presented to the aerial coil by the feeder. If the test is carried out as described, and then the connection of the feeder shows that the tuning has been "pulled," the answer is that the feeder does not, as it should, look like a pure resistance. This is a good indication of mis-match **at the aerial end** of the feeder, and this should be corrected. When this is done, the R.F. circuit of the converter will tune in satisfactorily as before.

For the setting-up of the 6-metre band, the procedure is identical with that outlined for ten metres. This time, the fixed oscillator should be set on 42.5 mc/sec., and a check should be made to ensure that the output circuit of the converter will tune from 7.5 to 11.5 mc/sec. Adjustment of the mixer and R.F. coils is undertaken in exactly the same way as before.

OSCILLATOR INJECTION

When a pentode mixer is used, as here, an important feature is the amount of oscillator voltage fed to

(Concluded on page 51.)

NEW ACHIEVEMENTS IN ELECTRONICS

Britain Makes One Thousand Million Components a Year

By FRANK CLAWES, economic and industrial journalist on the staff of a leading United Kingdom newspaper.

It is difficult to offer a description of the British electronics industry which does not consist of a series of "tall" stories. For this there are two reasons. The first is that the industry is making rapid advances over a wide area of potential and actual applications and quite remarkable achievements are being announced almost every week—the tall stories are, in fact, true.

The second reason is the lack of any genuine alternative treatment. It is extremely difficult to state the limits of the electronics industry, and no official statistics yet presume to do so. Indeed, there is still no agreed definition of electronics itself, since the fairly recent discovery of semi-conductors rendered inadequate all previous definitions. Perhaps the best way to assess the industry is to state the volume and value of the manufacture of components.

FIVE TIMES PRE-WAR RATE

Components are now being produced at the rate of about 1,000,000,000 a year, which is substantially more than five times the pre-war rate. An even bigger change is that, whereas before the war 90 per cent. of components were used by the domestic radio and television market, this percentage has now fallen to 45 in spite of the enormous growth in television in the United Kingdom since 1945. General radio communications and radar alone absorb about 200,000,000 components and a further 160,000,000 are directly exported; telecommunications take 50,000,000, sound reproduction 50,000,000 instrumentation takes 20,000,000, and miscellaneous uses absorb 40,000,000. The value of all these components is about £50,000,000. Two things should be noted about this list: the relatively large "miscellaneous" classification hints at the great variety of uses, and there is no specific category of "military purposes."

Obviously, little is known of most of the military applications of electronic principles. Modern military aircraft carry large quantities of electronic equipment and a modern bomber will have more than 1,000 valves on board; this, however, is only a development of practices of the recent war. The most startling developments are taking place in the field of guided missiles.

Production orders have already been placed for guided missiles for fighter aircraft. Another type, under development, is an anti-aircraft missile fired from the ground. A ship-to-air missile may be tested by the Royal Navy next year. Many British guided missiles of all types have been fired in the course of development work.

TESTING EQUIPMENT

Additional to the missiles is much electronic testing equipment. For example, Winston Electronics Ltd. has devised test gear which can check all the individual controls of a guided missile, and then, by simulating a target with a changing range and bearings in two dimensions, test the homing properties of the weapon. The same firm has made for the United States Government a sequential image converter—or electronic camera—in which the exposure time has been reduced to one-tenth of a millionth of a second, with a repetition of 0.5 microseconds; six successive frames are presented on the face of a cathode-ray tube and photographed simultaneously. This is believed to be the fastest working camera in the world, and is to be used on rocket testing.

Such things may seem remote from radio receivers and television sets, but the enormous sums now being spent on defence convey immense commercial benefit on the electronics industry, especially in the improvement of component design. Military requirements demand that components should function with utter reliability under great stress, at high altitudes, at extremes of temperature, under heavy surge currents, and yet be increasingly smaller and lighter in construction.

The second feature of the breakdown of the industry's component output is the wide range of applications suggested by the "miscellaneous" category. Perhaps nothing can better illustrate electronics' capabilities than the investigation into the causes of the explosion of a Comet aircraft on 10th January, 1954.

HELPED SOLVE COMET MYSTERY

Nobody saw the disintegrating Comet enter the Mediterranean Sea, but it was important to reconstruct the pieces which had to be presumed to have spread over an area of 100 square miles (259 square kilometres). Conventional Asdic and other still secret electronic devices located under-water obstacles; when they were pin-pointed with complete accuracy, a television camera, lowered into the sea, identified the objects and suggested the best way of grabbing the debris without further damage. Meanwhile, in Britain an "Ace" (automatic computing engine) was being used to investigate hitherto unsuspected problems of aerodynamics. It is fair to say that, without electronics, the mystery of the Comet could not have been satisfactorily solved.

Since then, the English Electric Company Ltd. has manufactured the "Deuce" (digital electronic universal computing engine), an advanced model of the Ace. The Deuce, which is claimed to be the most capable of its kind in Europe, has a capacity limited by its 12 mercury delay lines each storing 32 words, ten shorter lines, and a magnetic recording drum storing 8,192 words, or more than 250,000 digits. The Deuce has already solved a set of 115 simultaneous equations with 37 right-hand sides, although problems of a tenth of this magnitude could not otherwise be tackled.

On an altogether different scale (and costing 25 times as much) is "Tridac," a three-dimensional analogue computer made for Britain's Royal Aircraft Establishment by Elliott Brothers (London) Ltd. It is said to do as much work in 20 seconds as 100 girls using calculating machines in an eight-hour day.

(Continued on page 31.)

The PHILIPS Experimenter

An advertisement of Philips Electrical Industries of N.Z., Ltd.

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Previous instalments of this series have illustrated how transistors, and in particular those manufactured in the Philips factories, may be used for a wide variety of purposes. Many of the applications illustrated have been ideal for use by amateurs, while others are specially useful in such diverse fields as television and electronic computers. But the day has not yet arrived when it will be a commonplace to find transistors used in all these ways. There is one field, however, which transistors have invaded with every success, and which has already caused the transistor to be in daily use by the man in the street. We refer, of course, to hearing-aid amplifiers. The transistor has really arrived among us, and is by no means still a laboratory curiosity.

In spite of this, it seems that, for some little while, every-day applications of transistors will still be chiefly in the field of audio amplification. Circuits for this work have been developed in great profusion, and it will not be possible to do more than scratch the surface of what is already a large subject, but it is such an important one that even the sketchiest review of transistors cannot but deal with it in some degree.

GROUNDED EMITTER CIRCUITS

Of the three basic arrangements which have already been briefly described, the grounded emitter circuit is the most important in transistor audio work. The main reason for this is that it provides the greatest power gain of the three, and a secondary, but important, one is that, of the three, its input and output impedances are of more generally useful values. In particular, its input impedance is higher than that of the grounded-base circuit, without being so high as to be inconvenient for matching the impedance of a microphone, or the output impedance of another transistor. The point of most practical interest is the question of how the correct operating conditions are obtained. We are very familiar with the answer to this question, as applied to an ordinary valve, but with a transistor, setting up the correct bias for the emitter for example, presents some novel problems. Let us take the case of a transformer-coupled grounded-emitter circuit, which we have drawn, stripped of its D.C. complications, in Fig. 1. As we are concerned first of all with the static operating conditions, corresponding exactly in principle with the D.C. conditions in a valve circuit, it is clear that the fundamental arrangement of Fig. 1 will have to be modified in such a way that the signal circuit remains the same, while provision is made for applying the necessary battery voltages and securing the proper operating currents in the electrode circuits.

In a previous instalment we gave simple illustrations of how separate batteries could be used, so as to make the emitter and collector circuits as independent of each other as possible. In practice, however, it is always desirable to use only one battery if possible, so we shall attempt to do this. In the first place, the collector must be supplied with a negative potential with respect to both emitter and base, so that as a first step we will include a battery as drawn in Fig. 2. As in some hearing-aids, this can well be a 1½-volt cell, and reference to the characteristic curves for the Philips OC70 show that, with this supply voltage, a suitable emitter current is 0.5 ma. The tables show that the average current amplification factor of this transistor is 0.95, which means that if we achieve our desired emitter current, the collector current can be predicted, and will be $0.95 \times 0.5 = 0.475$ ma. Since both these currents flow either to or from the base to the respective electrodes, it is obvious that there must be a net current flowing in the base connection, and, moreover, its value must be $0.5 - 0.475 = 0.025$ ma., or 25 μamps. Now, in Fig 2 we have depicted the base circuit as decoupled by an electrolytic condenser, but with no D.C. return to the rest of the circuit. Under these conditions, there can be no net current in the base lead, so that in order for the required conditions to obtain, the "cold" end of the input transformer will have to be connected to the correct potential, either negative or positive with respect to the earthed end of the battery. The problem is, therefore, to decide whether the required potential is negative or positive, and what resistance there should be in the connection, if the correct currents are to flow in the circuit.

Imagine for a moment that the "cold" end of the transformer is earthed, and that the required emitter and collector currents are in fact flowing. This gives us Fig. 3, in which the arrows show the directions of the emitter and collector currents as they flow in the base lead, and also the direction of the net base current.

With this picture before us, it is not difficult to see that, for the base lead current actually to flow in this direction, the base lead must be returned to a point whose potential is negative with respect to the earth terminal. This is very fortunate, because we already have such a point—viz., the negative terminal of the collector battery. To find how much resistance must be included if we connect the base return lead to this point, all we have to do is to work out a simple sum in Ohm's Law, as the voltage and current are both known. In the example cited, we have

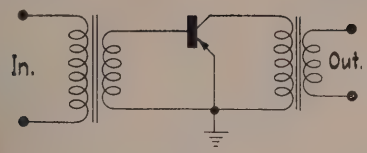


Fig. 1

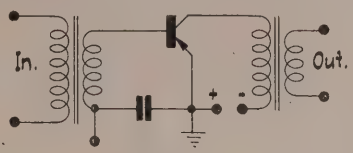


Fig. 2

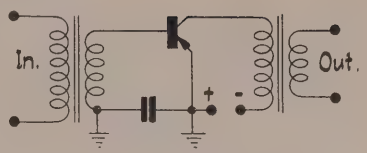


Fig. 3

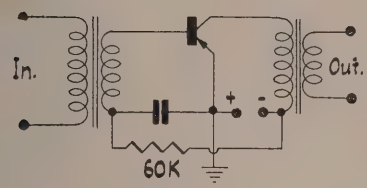


Fig. 4

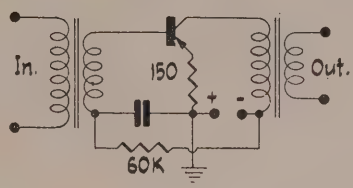


Fig. 5

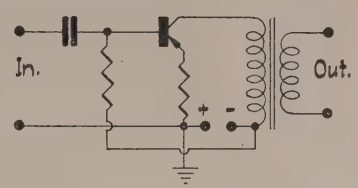


Fig. 6

$$R = E/I = \frac{1.5 \times 10^6}{25} = 60k.$$

As the D.C. resistances of both the transistor junctions, and the transformer secondary, are very much smaller than this figure, they need not be taken into account, and the final circuit appears as in Fig. 4, and provided the transistor is true to its published curves, we will find that the calculated currents do indeed flow. This method is called fixed bias, as it is comparable to fixed biasing of a valve. Unfortunately, it is not a very suitable method for transistor biasing, because of the fairly wide variations between individual samples of transistors, and because of the dependence of their characteristics on temperature. An increase of temperature, for instance, will cause the emitter current to increase. This causes the collector current to increase, too, and with it the base current. Now, an increase in base current will in turn cause the emitter current to increase, and so on, the process being a regenerative one, which therefore tends to accentuate fluctuations in the operating currents caused by temperature variation. This does not mean that the simple fixed bias circuit cannot be used, but it does indicate that in mass-produced applications it would be quite unsuitable unless some means of stabilization can be found. This can be done quite simply by inserting a small amount of resistance in the emitter circuit, as in Fig. 5. We leave it to the reader as a simple exercise, to reason out the fact that this gives negative feedback, and tends to offset the temperature effects. If the resistor is unbypassed, the negative feedback is effective both at D.C. and A.C., and so stabilizes both the D.C. operating conditions and the signal amplification, which, of course, varies with temperature as well as the other characteristics. If gain variations do not matter very much, the resistor can be bypassed, giving back the full stage gain, but retaining the D.C. stabilization.

Before we leave this circuit, we should show the exact arrangement which we obtain when the input is capacity-coupled instead. This is shown in Fig. 6. The 60k. resistor remains unchanged in value, but is connected directly to the base. As the circuit's input impedance is at most a few thousands of ohms, the 60k. can have no appreciable effect on the signal performance, but it should be realized that the blocking condenser must have a very high value, particularly if the circuit has to handle low frequencies. For a response similar to a valve's grid circuit having a 0.05 μf. condenser working into a 0.5 meg. grid resistor, the blocking condenser would need to have a value between 12 and 25 μf. It can be appreciated, therefore, why special low-voltage sub-miniature electrolytic condensers have been developed in the Philips laboratories specially for transistor circuits.

TRANSFORMER OR RESISTANCE COUPLING

Just as valves can be coupled together either by transformers or by resistance-capacity coupling, so can transistors. A point of some consequence is that of deciding which method is the best. For the valves, transformers have been almost entirely superseded by R.C. coupling, because, for the same fidelity in the coupling circuit, the transformer is much the more costly, and because it has other disadvantages as well, mainly having to do with the fact that the inter-stage transformer is a voltage step-up one, working from a quite high impedance to a very much higher impedance. For transistor inter-stage coupling, however, the transformer is not nearly so difficulty or costly a

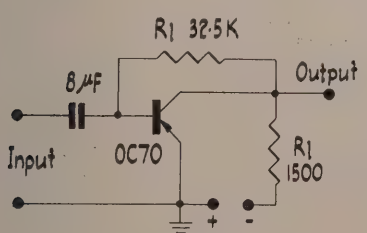


Fig. 7

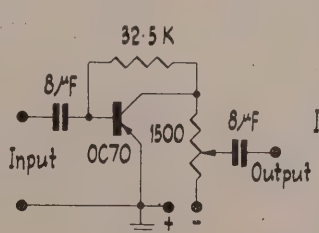


Fig. 8

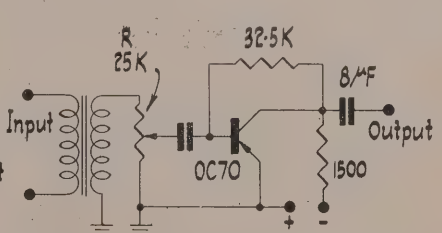


Fig. 9

device, for it has a step-down ratio, and works between impedances both of which are quite low. This being the case, there are applications in which the extra expense of the transformers is amply justified. One of these is in hearing-aid amplifiers, in which three transistors, with transformer coupling, are able to provide enough over-all gain even after some has been purposely sacrificed in favour of the gain-stabilizing effect of negative feedback, and more still has been given away in the interests of D.C. stability. The same results, in terms of amplification and both kinds of stability, could be achieved only with difficulty, and perhaps not at all, using four stages with resistance capacity coupling between them.

SELF-BIAS

In spite of what has been said above, resistance-coupled stages are still important, and there is a method of obtaining stable operation which is analogous to the self-biasing of a vacuum tube, and which is applicable to resistance-loaded transistor stages.

Such a stage is drawn in Fig. 7. The resistor R_b is the self-bias resistor, and R_1 is the load resistor, of 1500 ohms. The question now is, how do we fix the value of R_b? If we look at the published characteristics for a Philips OC70, we find that, in grounded emitter connection, a supply voltage of 1.5, and a load resistance of 1500 ohms, a suitable operating point is one which gives a collector current of 0.57 ma. Thus, by Ohm's Law, we find that a direct voltage of 0.85v. is dropped across the load resistor, leaving 0.65v. at the collector terminal. Now the curves also tell us that the steady base current will be 20 μamps. Thus, finding R_b is now only a matter of finding what resistance is needed to allow a current of 20 μamps. to flow from a voltage source of 0.65v.. We therefore have—

$$R = \frac{0.65 \times 10^6}{20} = 32.5\text{k}.$$

The stabilizing effect of this arrangement comes about because variations in collector current cause variations of D.C. collector voltage. These, in turn, affect the base current in such a way as to oppose the original change. In other words, the scheme is another application of negative feedback. There is a slight effect on the amplification, but only a slight one, because the input impedance of the circuit is low, and only a very small fraction of the A.C. output voltage is effectively applied back to the base.

These examples serve to show that, in spite of their unfamiliarity, transistors can be made to work as amplifiers by applying the same simple graphical methods, and the same simple Ohm's Law calculations that we are quite used to applying in the case of conventional valves.

GAIN CONTROL IN TRANSISTOR AMPLIFIERS

To round off the picture of simple transistor amplifiers, let us finish with an indication of how volume control is applied in such circuits. Two standard methods are shown in Figs. 8 and 9. In the former is shown a suitable method of inter-stage gain control where the coupling is of the R.C. variety. Where the stage before the volume control is transformer coupled, Fig. 9 shows a satisfactory method. The resistance of the potentiometer in this case should be at least ten times the output impedance at the transformer secondary, so that proper matching between the stages is affected at the position of maximum gain.

CONCLUSION

In a full treatise on transistor audio amplifiers, mention would have been made of Class AB and Class B amplifiers—both push/pull, of course—and of a class of circuits known as possessing what is called complementary symmetry. This is a class of amplifier that has no counterpart in ordinary valve technique at all, for it depends on the existence of a transistor which behaves as a valve would if we could make one which used electrons which were positively instead of negatively charged! These few typical arrangements will, we hope, serve to introduce the subject to those who are interested in these new devices, and to show that there is nothing very mysterious about making them work.

N.Z.A.R.T. NOTES

The achievements of the Nelson Branch at its first Industries Fair provided much publicity for the Association. Its organized message-handling scheme assumed greater proportions than had been anticipated, and, due to heavy traffic, messages on some occasions were still being cleared from relay stations well after midnight. The Nelson boys deserve congratulation on their efforts, with a special vote of appreciation to those who had to sleep on the job, due to the Fair being housed in large tents. Even Nelson nights can be chilly!

At the Industries Fair in Brisbane, a station operating on 40 metres put out quite a good signal to New Zealand.

April and May in Christchurch have been the busiest months for some years for the local Club. With Conference looming up, a station operating at the Christchurch Industries Fair, and the local "Junk Sale," things have been hectic. The Conference demonstrations of Amateur Facsimile, Model Control, and the film on the manufacture of "Permali" should do much to provide relief from the customary incessant talking at such gatherings!

The Christchurch Industries Fair provided some headaches, the greatest of which was combatting the local interference. Attempts to overcome this problem consumed much time, and, if nothing else was gained, the local amateurs now have a deep appreciation of their home locations, considering even the worst to be bearable! Many of the stations contacted were relayed to the Fair via a channel on 160 metres, and some found their way in through two.

The N.Z.A.R.T. Contest Season is with us again. The Sangster Shield in May, followed by the Memorial Contest and the Frequency Measuring Contest, with the VK/ZL DX Contest later in the year, will provide contest activity for all amateurs in one way or another. The slow, but evident, improvement in conditions may provide better conditions for some of these events and result in higher scores than have been the order of the day over the past few years.

The Amateur Radio Emergency Corps has been in action again, this time providing communications during a search for a missing climber on Mt. Egmont. Two sections were involved, but after setting up a basic net their services were no longer required, as the climber found his own way home the following morning.

The higher frequencies have returned some surprises over the past few weeks. Ten metres shows the odd opening to the North American Continent, 20 favours a few South Africans, and 40 opened to South and Central Africa on more than one occasion in the early morning. These 40-metre openings seem to have been confined to ZL2 and ZL3, and, although all signals were very weak and one-way conditions were indicated, a few in the Cape Town area were worked in a fashion. It appears that 10 and 15 metres will be returning soon, and many short-skip openings on the former band are reminiscent of the "good old days." Good conditions are definitely just round the corner . . . but nobody knows which corner.

Of recent months there have been several prosecutions for breaches of the wiring regulations. We regret to learn that amateurs have been involved in some cases where additional unauthorized wiring has been done. The practice of performin such wiring is deplored, as this could result not only in loss of property,

(Continued on page 46.)

New Achievements in Electronics

(Continued from page 27.)

Then, among others, there is "Leo"—manufactured by J. Lyons and Company Ltd., a catering firm, for its own use—which is designedly an office machine, and a digital computer made by Ferranti Ltd. In fact, a revolution in business accountancy and office routine has already begun, and the British electronics industry is at its fore.

ERADICATING WASTE

Another development which British firms have pioneered is in filming with electronic cameras. This eradicates the wasteful trial-and-error of conventional filming and, by use of multiple cameras and a monitor, permits the film director to control his film in the making. Intended primarily to produce cheap film for television, it will, oddly enough, help the cinema industry to compete with television as a rival. In television, Britain's next step is to make permanent the cable for "Eurovision"; colour television is only awaiting Government sanction; and a big export market is being built up (the Pye transmissions were the sensation of last year's Baghdad Fair and the transmitter and complete studio were bought on the spot).

More than half of all United Kingdom ships of more than 500 tons have been fitted with radar, and upwards of 4,000 overseas ships have been supplied, too. Ekco Electronics is the first firm in the world to go into regular production with search radar for civil aircraft, and the equipment is being fitted in the new Britannia aircraft. Britain was again first in the world with electronic switch control of telephone exchanges, and six such directors have been working in the Richmond exchange, near London, for more than three years; they provide a silent service with substantially less mechanical wear.

Another activity in which Britain is to the fore, and in some respects away ahead, is nuclear fission, the service of electronics in this respect has called for a new word, nucleonics, and reliable nucleonic instruments are now available. In medicine, electronic instruments, such as the electronic microscope, are now commonplace.

LIMITLESS POSSIBILITIES

Industry provides virtually limitless possibilities for the application of electronic technique. The automatic control of processes (right up to the control of a rolling or blooming mill), the examination for flaws of solid steel, controlled machine tools, electronic welding—these are becoming the accepted way of doing things. There remains only in the future the fully automatic factory. This is not the place to discuss how soon it will come or what its effects will be; these matters are still for speculation. But there is no doubt that Britain's electronics industry will be able to provide reliable equipment to control the factories if it is needed.

In more than one sense, the electronics industry is a peculiarly British one. Fifty years ago the thermionic valve was invented by Sir Ambrose Fleming, and a contribution to radar of almost comparable magnitude was made by Sir Robert Watson-Watt. Now a large-scale industry exists. And because its products contain a large element of skill and brainpower, it is the most appropriate industry for a nation which reckons skill and brainpower as its chief raw material.

NEWS FROM GOVERNMENT DEPARTMENTS

ELECTRON MICROSCOPY

Prior to 1949, there was no electron microscope in New Zealand, but now, after five years' experience with a British-made instrument, the Department of Scientific and Industrial Research has reviewed the usefulness of this equipment in its relation to medical, agricultural, and industrial research.

An electron microscope was installed at the Dominion Physical Laboratory, Department of Scientific and Industrial Research, in 1949, and it has introduced a whole new field of science, since detail in objects which previously could only be seen indistinctly, if at all, can now be clearly resolved and examined critically. The laboratory has a highly-skilled section to prepare the material for examination and to operate the microscope. This staff has greatly improved the performance of the electron microscope since it has been installed, and high praise has been given to them by outside organizations for the quality of their work.

The great benefit of the electron miscroscope is its high resolving power leading to high useful magnifications. The conventional optical microscope will give a useful magnification with white light about 1,500 times, and with ultraviolet light this can be increased to more than 2,000 times. In optical instruments, magnification beyond these limits only makes the image appear indistinct, since no more new detail can be resolved. An electron microscope uses electron beams instead of visible light beams and specially shaped magnetic fields instead of glass lenses. Such an instrument—enabling useful magnification of 200,000 times to be achieved. The Dominion Physical Laboratory instrument has a useful limit of about 50,000 x. At this magnification, bacteria appear several inches long.

The electron microscope at the Dominion Physical Laboratory is referred to as a "national instrument," for the services of the staff are available to all New Zealand organizations that are making relevant scientific studies. In addition to the main equipment, much subsidiary equipment has been installed at the laboratory. A special instrument was developed to cut some materials into thin sections only a few millionths of an inch thick. Biological samples must be carefully prepared and stored, bacteria sometimes have to be cultivated, results have to be interpreted, and much other work that is sometimes outside the normal experience of the staff has been undertaken.

The review of the usefulness to the Dominion of the electron microscope shows that there is more than enough work to keep the instrument fully employed. Important work has been done in chemical, agricultural, and biological research; it has been possible to make considerable progress in the investigations on the structure of teeth (in association with Dental School in Dunedin), on classification of soil types, on tobacco mosaic virus and the effect on disease saps of chemical treatments, on examination of paint pigments, farm animal research problems, and many other studies where progress was delayed through inadequacy of the optical microscope have been helped forward.

* * *

FREQUENCIES for "RADIO NEW ZEALAND"

From Friday, 13th May, 1955 (New Zealand date), "Radio New Zealand" will transmit in accordance with the following frequency schedule:—

(1) TO AUSTRALIA:

2000 to 0600 GMT	ZL19	11.83 Mc/s. in 25-metre band
0615 to Close Down	ZL18	9.52 Mc/s. in 31-metre band

(2) TO PACIFIC ISLANDS:

1700 to 2030 GMT	ZL20	6.02 Mc/s. in 49-metre band
2045 to 0600 GMT	ZL 3	11.78 Mc/s. in 25-metre band
0615 to Close Down	ZL 7	6.08 Mc/s. in 49-metre band

Close down is at 1045 GMT on week-days.
1120 GMT on Saturdays.
1000 GMT on Sundays.

News Bulletins may be heard at:

1800 hours GMT (London News).
1900 hours GMT (London News).
2000 hours GMT (London News).
0033 hours GMT (N.Z. News).
0630 hours GMT (London News).
0830 hours GMT (N.Z. News).
1030 hours GMT (N.Z. News).

Please note particularly that transmissions to Australia and the Pacific Islands now commence at 2000 hours GMT and 1700 hours GMT respectively, instead of 1800 hours GMT.

RECORD TALK

By JOHN GRAY

The latest Festival release can honestly be claimed to have "something for everyone," from those who admire the Andrews Sisters to devotees of Bruckner and Mahler. The most celebrated of all groups of "singing sisters" are in Latin American mood on CFR 10-390, with such stand-bys as "Begin the Beguine," "Tico Tico," "South American Way," and several others. Guy Lombardo's offering this month is in the same vein, with "Begin the Beguine" well to the fore among the items on CFR 10-392. An unexpected release is an "original cast" selection from a musical comedy of a few years back, "Arms and the Girl." It has been described as "an enthusiastic example of the old-fashioned operetta spruced up for modern consumption." The background to the story is the American Revolution, and the musical numbers are both amusing and clever. The artists include, by the way, Pearl Bailey (CFR 10-547).

For those who like simply a collection of good tunes (and there can never be enough records of the type), Peter Yorke's selection of Victor Herbert melodies on CFR 10-355 will undoubtedly be welcome, as will a further Jesse Crawford offering on CFR 10-565. A ballroom orchestra hitherto not represented in local lists is that of "Lawrence Welk and His Champagne Music," who make their bow with numbers dedicated to various musical "girl friends"—Louise, Mary Lou, Dolores, Irene, etc., on CFR 10-572.

The classical list is interesting out of all proportion to its modest size. Bruckner and Mahler are two composers who traditionally, and almost officially, do not appeal overmuch to British music-lovers, although the latter's works have undoubtedly made some headway within recent years. His "Song of the Earth" is due for its first live performance in New Zealand this year. It is perhaps the easiest approach to Mahler's music, comprising as it does exquisite settings of six old Chinese poems, three each for contralto and tenor soloists, the whole strikingly and fascinatingly orchestrated. The Decca set by Kathleen Ferrier and Julius Patzak, and Bruno Walter conducting, on three sides of two L/Ps, has become a classic of our time. Now Festival offer a version by Elsa Cavelti and Anton Dermota, with the Vienna Symphony Orchestra under Otto Klemperer, on CFR 12-508, the whole being accommodated on two sides, with a consequent reduction of expense. Frankly, performance and recording are not up to Decca's standard, but the new issue is at least adequate, and the tenor, Dermota, does something like justice to a difficult part. The recording can certainly be recommended to those unprepared to pay twice as much for the other.

For lovers of the rambling but endearing symphonies of Bruckner, a Westminster album (WAL 201) brings the first recording ever, of his sixth, in A major. Henry Swoboda conducts the Vienna Symphony Orchestra in this three-sided set, the spare side being given over to Bruckner's settings for chorus and orchestra of Psalms 112 and 150. A further large-scale Westminster set contains the first 15 of Liszt's Hungarian Rhapsodies, played by a Hungarian pianist, Edith Farnadi, who has been heavily promoted by Westminster as an authentic interpreter of Liszt's music. Miss Farnadi is not an impeccable player, and fifteen rhapsodies on end may strike the ordinary music-lover as rather too much of a good thing, but this issue does demonstrate more variety of mood and music than one might expect, and the total impression is undoubtedly exhilarating. These two discs contain a full measure of rhythm and excitement, though the piano tone is not always of the most pleasant (WAL 213). After these huge offerings, the remaining Festival disc could well be used as a soothing nightcap. Two suites for strings, one by Rameau and the other by Boyce, who are among the most tasteful of the eighteenth-century composers, are played by a string orchestra conducted by John Bath on CFR 10-577. Boyce's suite is intriguingly called "The Shepherd's Lottery."

From Radio Corporation come two nursery rhyme records on the Fidelity label (FY 1039 and 1048) presented by the Australian artists, Johnny O'Connor and Bobby Limb, and featuring between them more than a dozen of the best-known and loved rhymes. For the older children there is a considerable number of "Bugs Bunny" items released on Capitol. There are fewer Tanza releases than usual, but their number one hillbilly star, Luke Simmons, comes up with a new version of that undying tear-jerker, "Old Shep," on Z 243. Some light relief being necessary for the coupling, we have a catchy tune dating back to the twenties—"I Miss My Swiss." Tanza announce a new colour scheme for their labels. Standard tunes will continue to appear in the familiar bright green, but hillbilly are now garbed in a mixture of blue and brown, and Hawaiian style numbers will appear clothed in ruby red, as witness Daphne Walker's new disc of "Maori Brown Eyes," coupled with "How d'ya Do," on Z 241.

Philips are as alert as ever in the popular field, and their classical flow, which began as a trickle, is already developing into a flood. The pops include the two-sided Harry James version of "Stompin' at the Savoy" (B 21444), Rosemary Clooney, a little late but none the less welcome, with two of her songs from 'White Christmas" (B 21458), and the Beverley Sisters to tell us about the Naughty Lady from Shady Lane (P 26157). Miss Clooney also turns her attention to the children with two very bright numbers, "Little Tinka Toy Man" and "Here Comes the Ice-cream Man," on B 21261.

On the serious side, Philips have produced some standard works and some that are far from that. As in the case of Festival, the attraction here is a work by Mahler, his largest, and, indeed, one of the most colossal compositions extant. This is the Symphony No. 8, popularly known, and with fairly good reason, as the "Symphony of a Thousand." On this occasion, the Holland Festival, which organized the performance thus perpetuated, went one better in employing something like 1100 participants, 900 in the choir and 200 in the orchestra, plus a dozen soloists. The symphony is very largely choral and comprises settings of the old Latin hymn, "Veni Creator Spiritus," and a large portion of the second part of Goethe's "Faust." As often happens in the case of Mahler recordings, this was made at the public performance in Rotterdam conducted by Eduard Flipse. Extraordinary precautions were taken to ensure good results. All trams were diverted from the vicinity while the performance was on. Music stands were fitted with lined receptacles into which string players could drop their mutes. Programmes were printed on special paper that would not rustle (we are not told whether the sheet music was also of this variety). And here, less than a year later, we have it all served up on two L/Ps (ABL 3024-5). More I cannot say; I haven't heard it as yet.

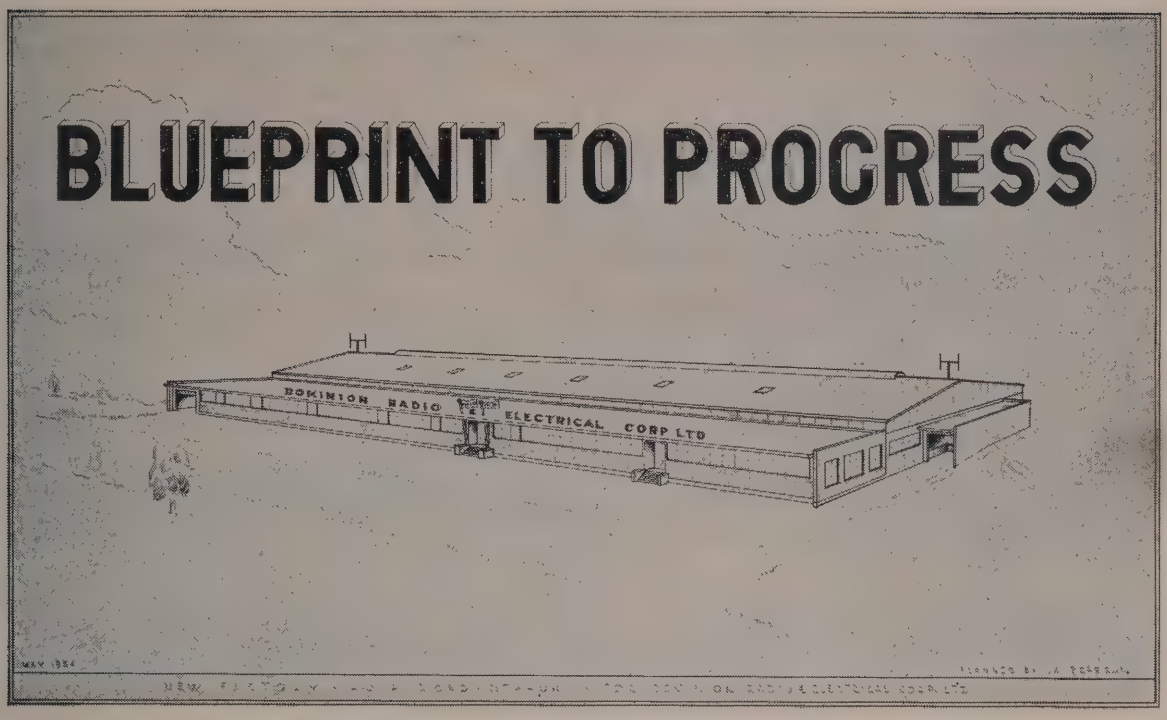
Other highlights of a splendid Philips list include a classic performance of the Brahms violin concerto by Isaac Stern and the Royal Philharmonic under Sir Thomas Beecham (ABL 3023), and Sir Thomas is also well in his element with Tchaikovsky's "Little Russian" symphony, a work unavailable here for quite some time (ABL 3015). Then there are two choral discs of widely differing types: Faure's beautiful and moving "Requiem" by a Paris ensemble under Jean Fournet (ABR 4012, a ten-inch release) and a bright programme of Mozart, Schubert, and Strauss by the Vienna Boys' Choir, a disc that should sell by the hundred (NBR 6007). A new Kostelanetz record is labelled "Carmen, Opera for Orchestra," and is exactly that. I have often heard people say that opera would be all very well if it weren't for the singing, and it is obviously for them that there comes "Carmen" without voices on NBL 5003. Strictly speaking, of course, this is simply an enormous "Carmen" selection, but divided into the four acts and with everything played in the right order. Scarcely half of the full score is here, but the experiment is an interesting one and the actual recording is superb. I hear that similar Kostelanetz treatments of "La Boheme" and "La Traviata" are on the way.

HMV's popular releases include a tasteful Mantovani coupling of "Lazy Gondolier" and "Lonely Ballerina" (Y 6654), and there are some Columbia releases stemming from their recent tie-up with the American Coral catalogue. For instance, Teresa Brewer on DNZ 15 revives a very old hit of the twenties (what a wealth of catchy melody there was in that distant and still somewhat despised era!) entitled "My Sweetie Went Away" and a new male quartet in the persons of the Rover Boys entertain with "Show Me" and "You've Got It" on DNZ 13. Lawrence Welk turns up on this label, also, and DNZ 16 features his presentations of "Devil Lips" and "In a Little Spanish Town." An old friend of the keyboard now appears on HMV: the artist is Ben Light, and his numbers on HR 10054 are "Maybe" and "I Don't Want to Walk Without You." The top version of the "Naughty Lady from Shady Lane" is, of course, that of the Ames Brothers; their backing on HR 10050 is "Addio." Remember the old six-sided set of "Max Miller in the Theatre"? It is back again under its original numbers of EA 2761-3, and will entertain a whole legion of his admirers.

The sound-track recording from the new "Brigadoon" film is already here and may be had on MGM 02-7504 (L/P). Other film fans will be on hand for HMV ALP 1186, whereon Mario Lanza sings a galaxy of "Student Prince" numbers as well as melodious selections from other shows.

HMV have brought out a large number of English Brunswick L/Ps featuring many of the most popular of today's artists: Carmen Cavallaro, for example, whose soothing piano style appeals to millions. He is well represented by "Tangos for Romance" (LA 8661) and an unnamed selection which ranges from "September Song" to "You Made Me Love You" is on LA 8670. A record of curiosity value is LA 8557, whereon Rudolf Friml, the famous composer of musical comedies, turns pianist and plays eight numbers from his most enduring stage successes. For old-timers there is a medley by Eddie Cantor on LA 8658 (when I say "medley" in discussing L/Ps, I mean a collection of separate

(Concluded on page 50.)



Symbolic of Dominion Radio & Electrical Corporation's faith in the future is the modern Radio and Electrical Factory shown above.

The final issue of World War II was still undecided when DRECO purchased its six-acre site at Otahuhu. Courage was required in those days of uncertainty to plan a project the major part of which could not be commenced until the vital struggle in which the Empire was involved had been brought to a successful conclusion.

The opening of the administrative and radio manufacturing units brings to completion the first stage of an ambitious programme.

This has not been achieved without surmounting many major obstacles. The support from the trade, which reflects the increasing demand and full public acceptance of the Company's products, provided incentive and encouragement to overcome these obstacles. Already it has become imperative to commence further building extension.

Located at Huia Road, Otahuhu, the new plant is in the industrial area of Auckland. Ideally situated, it is sufficiently remote from general traffic noises to give pleasant working conditions and the low noise-level which is important in the several phases of radio manufacture.

Opening of the Dominion Radio and Electrical Corporation's New Factory at Auckland

The new home of Dominion Radio and Electrical Corporation is New Zealand's only plant specially designed and built for the manufacture of radio receivers and home appliances.

Careful thought has been given not only to the immediate requirements of radio manufacture in particular, but also to calls which undoubtedly will be made on Radio Manufacturers for television sets when this means of entertainment is established in New Zealand.

The first unit, containing the administration block and radio manufacturing section, was completed less than a year after the building permit was secured. Looking further to the future, extensions are already under way to cover radio cabinet manufacture. Radio manufacturers have universally experienced the greatest difficulty in securing high-class radio cabinets, and, to overcome this difficult problem, DRECO have under way further building extensions on their six-acre site. Already highly skilled personnel have been engaged and extensive plant which is now on the water will arrive to synchronize with the building's completion.

The factory proper is both airy and spacious. The lay-out is the result of considerable time and motion study in relation to manufacturing personnel and flow of raw materials. Numerous built-up models and plans were made and studied prior to the final decision regarding floor plan. All who have visited the factory to date, including overseas and local trade leaders, agree that nothing better has been seen in any other part of the world.

Straight-line production gives peak efficiency and is the goal of many manufacturers. The new DRECO plant is an excellent example of this manufacturing technique so rarely achieved in New Zealand. Raw materials enter one end of the 250 ft.-long building and pass through machine, metal, coil, transformer, sub-assembly, main assembly, to testing and packing departments for dispatch.

Service of any product in the field is governed by the standards of manufacture, which, in turn, can be maintained only by adequate testing and checking. Two striking features pertaining to radio manufacture are worthy of mention. Specially designed testing booths have an interior noise-level of 35 db. Cavity brick type construction, incorporating strawboard and exploded mica, allows for a transmission loss of 55 db. at 400 cycles.

New to the New Zealand radio industry is the vibrating soak test, where fully aligned radio chassis operate on power simultaneously with being shaken for a pre-determined period, prior to passing to the final quality controllers. These are major steps to support the PHILCO claim, "FAMOUS FOR QUALITY THE WORLD OVER."

The building's modern appearance and design are functional as well as pleasing to the eye. Brick veneer walls and large expanses of glass combine an attractive exterior with the adequate provision of natural light. A large overhang excludes the heat of summer, but allows maximum light and entry of the low warm winter sun. Colour has been skilfully used and contributes much to the appearance and interior decor of the building. This is perhaps seen in its most striking form in the staff cafeteria, which, in keeping with modern colour conscription, is designed not only to provide the normal amenities associated with a cafeteria, but does so in such a way as to give the staff maximum relaxation and comfort.

The building was planned by Dominion Radio and Electrical Corporation and was erected by them in conjunction with Messrs. W. H. Whittaker & Co. Ltd. When the site was selected, two things were uppermost in the mind of DRECO; ample space for future development and access to adequate local labour, coupled with a situation which had the minimum of limitation as far as electronic manufacture was concerned, with a special thought to television.

The factory has been planned in such a way to allow rapid expansion into allied fields. The new project will still further consolidate the leadership of PHILCO and MORPHY-RICHARDS in the radio and home appliance fields. DRECO'S new plant is a further step forward by the virile and young electronic industry, which now plays an important part in our national economy. Should, unfortunately, the occasion ever again arise, this is an efficient electronic and electrical manufacturing unit which could play a major part in the defence of those things which New Zealanders cherish.

The Mayor of Otahuhu officially opened the building on 3rd May. It was a really gala day for those who had worked untiringly for the completion of this modern factory. Set in lawns and shrubs, the factory was to be seen at its best; the weather was perfect, scarcely a breath of wind, and a cloudless sky. Immediately following the opening, appropriate and substantial refreshments were served to provide a fitting end to the enjoyable function.

The goodwill which is enjoyed by both Dominion Radio and Electrical Corporation and its distributor, Russell Import Company Limited, was clearly indicated by the many busy people who had given their time to attend the function and wish them well in the years to come.

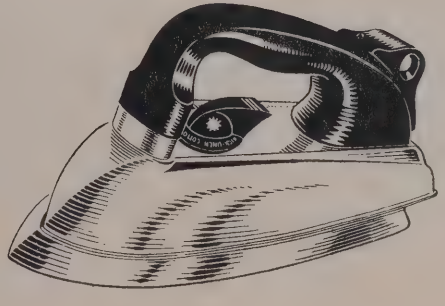
excellence

Fully in keeping with the facilities in the new Otahuhu premises are the superlative products which D.R.E.C.O. manufacture. The Philco MONTANA Radio illustrated at left is a creation of which any manufacturer could be proud. Yet this is only one of a range of Philco models, each built to the same exacting standard of technical excellence, and justifying the claim:

"Famous for Quality the World over."

Philco MONTANA

Similarly, the world-famous Morphy-Richards Automatic Iron—by far the most widely used household iron in New Zealand. Renowned for its perfect balance and construction, renowned for its beauty and value, renowned for its reliability . . . all the qualities that are "in-built" by D.R.E.C.O.



MORPHY-RICHARDS Iron

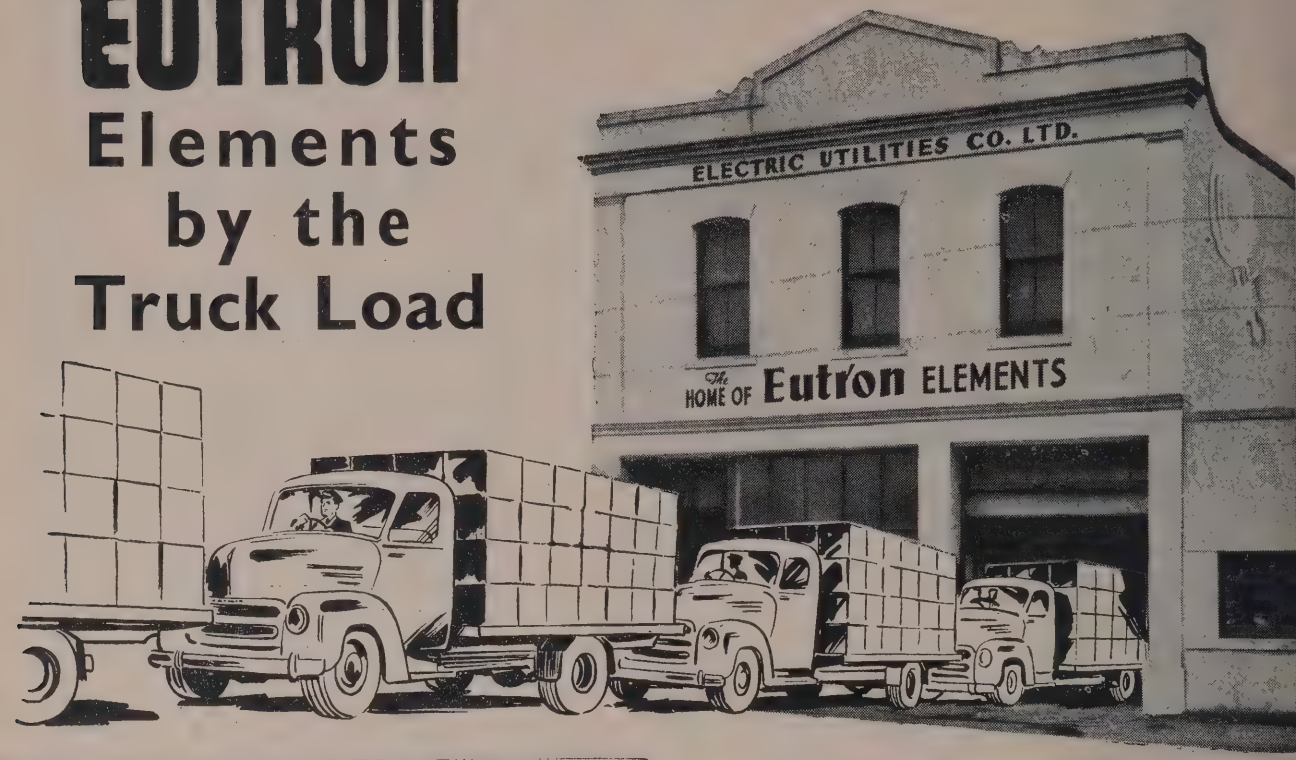
Distributed throughout New Zealand by

RUSSELL IMPORT COMPANY LTD.

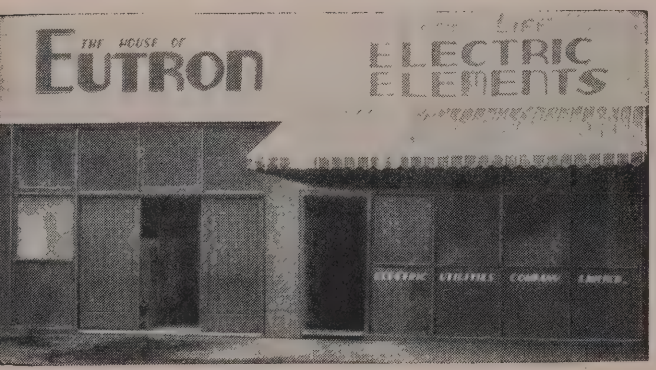
AUCKLAND WELLINGTON CHRISTCHURCH

EUTRON

Elements by the Truck Load



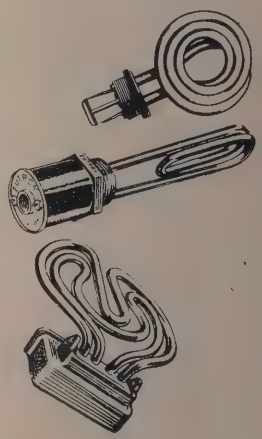
ABOVE: The new Eutron factory in College Hill which will become the main manufacturing plant and headquarters of Mr. J. Nicholson (Eutron Nick) Managing Director of the company.



ABOVE: The original factory in Grey Lynn where production will continue of special types of elements.

All types for WATER, OIL, AIR, RANGE

It's all happened in only nine years! From a mere handful of Jug Elements daily, the output of the now extensive Eutron organization has grown to thousands per week of not one type of element only, but to hundreds of types from two factories. The big demand from both commercial and domestic users is clear evidence of Eutron's superiority and reliability . . . proof that Eutron reflects the highest degree of technical skill and laboratory research necessary to the maintenance of standards of manufacture second-to-none! Electric Utilities can quote and deliver elements for practically any application.



ELECTRIC UTILITIES CO. LTD.

(Subsidiary of Nicholsons Holdings Ltd.)

316, GREAT NORTH ROAD, GREY LYNN W.2., AUCKLAND

ELECTRICAL AND TRADE SECTION

REFRIGERATION—Part III

(Published through the courtesy of the publishers of "The Practical Electrician's Pocket Book, 1955."

With all domestic refrigerators: check that the thermostat bellows tube of the control is securely fixed and is making good thermal contact with the evaporator. If the refrigerator is not running, make sure that the refrigerator is switched on. Ensure that there is no obstruction to the free flow of air over the condenser. Make sure that the cabinet loading is correct. The door gasket must seat properly, otherwise warm air will leak into the cabinet, causing temperature to rise. A check can be made by holding a visiting card at various points round the door, so that it is trapped between the cabinet and the rubber gasket, when the door is closed. Draw the card out, and if resistance is felt, the seal is satisfactory. Special attention should be paid to ensure that the condenser is free from dirt or fluff. See that the refrigerator is standing level on the floor.

A complaint of noisy operation may be traced to plates or dishes rattling on shelves. If the fault is external to food compartment, check whether unit has loose or defective mountings or the pipes are fouling.

SERVICE EQUIPMENT

Special Equipment. Special equipment needed for servicing both commercial units and hermetically sealed units is as follows:—

Halide leak detector. One pocket thermometer—20° to + 100° F.

Flaring block and yoke. Tube Cutter.

Set of S.A.E. spanners. Suction and pressure gauges.

Service valve ratchet spanner. Test Lamp of appropriate voltage.

Set of Allen Keys. Spring Balance for weighing cylinder when adding refrigerant to system.

Bending springs for soft-annealed copper tubing.

Other size spanners will also be required, these being of standard size.

Seeing that the cycle of operations involves correct balancing of temperature and pressure, only by the use of reliable vacuum and pressure gauges and thermometors can service be carried out efficiently.

Suitable compound gauges with a graduated reading on the vacuum side of from 0 to 30 inches, and the pressure side of 0 to 60 lb., and high pressure gauges reading from 0 to 200 lb. are available as single instruments, or in the form of a combined testing unit.

A compound gauge is always attached to the suction valve, and the high pressure gauge to the discharge valve using the shortest possible tubes. After fixing, air must be purged from the tubes before opening valves; also a test should be made for leaks at all joints.

Gauges should also be used for: testing low side for leaks; setting low side control; adjusting expansion valve; removing any part of the system; purging air; equalising pressure; and for most major repairs.

FAULTS, TESTS AND REMEDIES

It is important to remember that the "sealed" type of unit cannot be dismantled by the service engineer like a commercial plant or "open" type of domestic refrigerator. Where it is clear from the following instructions that the procedure described is impossible to carry out (e.g. the closing of valves, purging, etc.) the unit must be returned to the makers. In short, this means that the only servicing which can be done to a "sealed" unit is to check over and rectify electrical connections, starting relay and thermostat, or to disperse oil choke in the capillary tube by warming the evaporator. Many of the hints given are of course common to both types.

Machine Will Not Run—No Refrigeration. Possible causes: fuse blown, faulty motor, broken belt, relay open, transformer faulty, thremostat faulty (simple test lamp check is recommended), loose or broken connections.

Check supply to unit with test lamp. If no light, check fuses. If lamp lights turn thermostat to "coldest." Check supply to motor. If lamp lights across both windings (A.C. single phase type), motor is faulty. If lamp does not light across starting winding, relay or centrifugal switch is faulty.

To Check Relay for Open Circuit. Remove relay from fixings and turn so that terminals are accessible. The relay must be in correct operation position for tests with thermostat at "coldest" position. Put test lamp across incoming neutral and incoming live line; if **no** light, check supply; if light, check across incoming neutral and returning live line from thermostat, if no light, thermostat is faulty, and must be changed (it is important that same type thermostat be fitted). If lamp lights, check across incoming neutral, and supply, to running windings; if no light, relay is defective and must be changed.

An earthed circuit will cause the fuses to blow or trip the relay. To check, remove the neutral from relay, check with test lamp between relay live terminal and the following: Starting windings, running windings (both terminals), and return from control panel or thermostat. If the lamp lights or glows when connected across any of the above points an earthed circuit is indicated, and the following test should be carried out: remove control supply and return—if lamp fails to light, the control is faulty and must be changed.

Disconnect motor leads if lamp fails to light on above tests, the fault is then in the unit. This should

be changed, as no repairs to the unit can be effected in the field.

If the lamp still lights the relay has developed an "earth" and should be changed.

Machine Running—No Refrigeration. Possible causes: float valve stuck closed, or filter clogged; expansion valve filter clogged (indicated by vacuum on gauge, and cool or cold valve); expansion valve frozen with moisture inside (indicated by suction pressure being below zero pressure, and little or no frost on evaporator, but with valve cold or frosted); discharge valve leaking (indicated by gauge); suction valve leaking (gauge test of both valves locates trouble); unit low on charge (low suction and head pressures); entire charge lost (cold condenser, suction pressure zero or a vacuum with a head pressure of zero or very low); lost charge of feeler bulb of thermostatic expansion valve.

Where expansion takes place in a capillary tube, lack of refrigeration may be due to oil choke. Cure by heating evaporator with hot water in ice trays and blanket condenser as far as possible. Run for one hour.

Machine Runs Continuously—Partial Refrigeration. Possible causes: discharge or suction valve leaking slightly (indicated by gauge test); critical charge (hissing noise in expansion valve, or evaporator); expansion valve setting too high or too low (frosting or sweating of return line if setting too high, or indicated by compound gauge if too low); thermostat contacts may have welded up and fail to cut out(frosting of return line); thermostat "cut-out" point may be lower than the temperature of the refrigerant due to the expansion valve setting being too high; condenser may be choked with dust, causing high head pressure and general reduction of efficiency; feeler bulb of thermostat expansion valve in poor contact with suction line.

High, Low or Erratic Temperature. This may be due to a thermostat out of adjustment or with an intermittent short circuit. Always make sure that the bellows tube is clamped firmly to the evaporator. To check operation of the thermostat, empty and defrost evaporator. Place a thermometer on lower shelf, set thermostat at "normal" and close the door; the refrigerator should be run as long as possible, or at a minimum of an hour, and the cabinet temperature should then be between 38° F. and 42°F. If control is only slightly out of adjustment, this can be corrected by turning control knob to a warmer or colder position. If this does not rectify the fault the thermostat must be changed. If unit runs, but does not refrigerate, unit is definitely defective, and must be changed.

A leaky flapper valve (non-return valve in cylinder head) indicated by a tendency to run in short cycles, affecting refrigeration if leaking badly, may be detected by attaching the compound gauge, closing the suction line valve and operating the compressor for a few minutes until a 20 in. vacuum is reached.

If flapper is holding, gauge will remain unchanged, but will decrease slightly if left for a period of 20 or 25 minutes.

A leaky suction valve allows loss of efficiency on the compression stroke of the piston, by gas leak back into the crankcase, reducing compressor efficiency and interfering with refrigeration if serious.

To check float valve, close liquid line valve cutting off refrigerant supply to evaporator, run compressor (thus pumping refrigerant out of the evaporator and moving the float ball), open liquid valve after 5 minutes, listening for the rush of refrigerant into the evaporator. Repeat two or three times. To check expansion valve, repeat procedure but with expansion valve opened fully; after which it must be reset, by gauge reading, or by dial thermometer on evaporator as explained.

Clogged filters will show the same symptoms as stuck-shut valves, depending upon their position in the system. Flushing will help to determine, if refrigerant can be "rushed" through it to some other part of the system, that the filter is not clogged.

Compound gauge should never be removed from the suction side of a unit while registering a vacuum. To do so, would admit air and moisture. Nor should high pressures be allowed to build-up in the crankcase for longer than very short periods since it scrubs oil up through suction and flapper valves, and may force oil through the shaft seal causing leak.

Crankcase pressure should be "balanced" at zero (or not more than one pound above zero) on all occasions, when laying up a unit, or when removing parts or where removing compound gauge. To do this, simply open suction valve slightly to destroy the vacuum, and close quickly before the 1 pound pressure reading is reached.

It must be borne in mind at all times, that if a unit has enough refrigerant, an efficient discharge and suction valve, a good float or expansion valve, the unit **must** refrigerate. The use of gauges enables a positive check to be made, after which faulty parts may be repaired or replaced.

Thermostatic valves are often suspected when, in point of fact, they are in perfectly good operation, and it is advisable to be able to check them on site. This may be done with a drum of refrigerant and a set-up with gauges. Refrigerant drum is merely to supply pressure. Any refrigerant may be used to test a valve irrespective of whether it is the refrigerant being used in the system or not. The thermos flask should be filled with crushed dry ice, into which the bulb of the expansion valve is placed.

Open valve at service drum (be sure its drum is warm enough to give at least 70 lb. pressure on the high pressure gauge connected on the line to the valve inlet). Valve can now be adjusted, pressure on the outlet gauge being as follows:

Freon 12, 22 pounds; methyl chloride, 16 pounds; sulphur dioxide, 3 pounds.

These pressures are equivalent to an evaporator temperature of 22°F. and since the crushed ice maintains the bulb at 32°F. there is a difference of 10° or, in other words, the value adjustment is for 10° superheat. Tapping the body of the valve lightly during this operation, will determine if the valve is smooth in operation. The gauge needle should not jump more than 1 pound.

With a good valve, the pressure will increase a few pounds and then either stop or build up very slowly. With a leaky valve, the pressure will build rapidly until it equals the inlet pressure.

A NEW DICTATING DEVICE: THE GRUNDIG "STENORETTE"

Office work these days is being speeded by the introduction of many new electronic devices. Amongst the latest of these now available on the New Zealand market is the Grundig "Stenorette," which, as a result of its technical and time-saving features, has proved of considerable help in intensified rationalization of office work. The magnetic-tape recording and reproducing device weighs only 11 lb. It combines practical with pleasing design and its operation is surprisingly uncomplicated. The dictated words are recorded on a tape (25 minutes dictating time), to be inserted into the device in a jiffy, and featuring automatic reeling. The magnetic tape comes on a special-type spool and can be mounted from one side only; thus, any confusion has been made impossible, and the tape cannot come off when turned back. For every new recording, the tape is automatically erased, or, optionally, the erasure may be performed already in the course of the re-reeling operation. The service life of the tape is practically unlimited. The "Stenorette" is operated with 110/125/165/220- volt A.C. and supplied with a dynamic microphone. A telephone adaptor has been provided for the recording of dictations from the telephone.

The most obvious feature of the "Stenorette" is its simple operation by means of a few press switches. The operation requires no special and technical intricate knowledge or training whatever. Any secretary who has read the instructions for use will immediately be able to operate this device. The selection of the microphone sensitivity is performed by means of a knurled disc with two switched positions. The switching position "conference" is meant for recordings in case of a considerable distance between speaker and microphone; the other position is for close distance—i.e., for dictating. Top-quality recordings can be made even in noisy rooms with the switch in close-range position and the speaker talking closely into the microphone. Five press switches (left to right) at the front part of the "Stenorette" perform the following functions: The rapid-motion tape return, the rapid-motion tape advance, the recording, the reproducing, and the stop. Pressing the switch "Aufnahme" (recording) results in the lighting of a signal lamp at the microphone, optically indicating its readiness for recording. The "Stenorette" is started by a sliding switch at the head side of the microphone. The handy design of the microphone casing permits the convenient operation of the switch by the thumb or index finger. The switch can be used as a push-button switch for short-period recordings and as an engaged switch for prolonged recordings by lateral shifting with pressed-down button.

The recorded words can be controlled by direct reproduction over the microphone. For this reason, the key (tape return) at the extreme left has to be pressed shortly, and subsequently the stop key (extreme right). By pressing the reproduction key (second from the right) and by operating the sliding switch on the microphone, the words just spoken will be reproduced over the microphone working as a loudspeaker. After the last work, the recording process can be continued by pressing the key "Aufnahme" (recording). Thus, any correction of the recorded version is easily possible.

However, the "Stenorette" represents not only an excellent means for the smooth dispatch of daily correspondence, but it can also find additional application for the general recording of spoken information. In case of a conference, for instance, the microphone is placed in the centre of the table, and the sensitivity switch—i.e., the left knurled disc—is shifted into the position "conference." Next the key "recording" is pressed and the recording process can be started. Now, the "Stenorette" will precisely follow the conversation for 25 minutes. In this case, special care should be taken that several persons are not talking simultaneously, since the microphone is unable to concentrate on one speaker especially. For conference recordings, the microphone should be placed some distance away from the "Stenorette," whenever possible.

The "Stenorette," not any larger than a portable typewriter, will initiate something like a little revolution in modern office work. Considering an average of three hours dictating per day, carefully performed tests in a modern office have revealed that the "Stenorette" will save the dictating person 22 per cent. and the steno-typist even 47 per cent. of time and effort-work, in comparison with the good old shorthand method. It can be left to the judgment of every employer to figure out the profits he may have by using such an economical device in his plant.

New Zealand representatives for this revolutionary machine are Direct Imports (N..Z) Limited, P.O. Box 72, Hastings.—P.B.A.

NOW—A BETTER, FASTER, MORE COMPLETE SERVICE TO THE RADIO AND ELECTRICAL DEALER

RADIO PARTS, VALVES, TRANSFORMERS, SPEAKERS, RECORD-PLAYING EQUIPMENT, ELECTRICAL APPLIANCES, and FITTINGS, Etc.

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P.O. Box 279 — Palmerston North — 323A Main St.

TIME SWITCHES

FOR SALE

Time Switches removed from service and in working order, but being sold without warranty. All are electrically wound 230-volt, and most are Venner make.

Price £3, each.

TARARUA ELECTRIC POWER BOARD
P.O. Box 16, PAHIATUA.

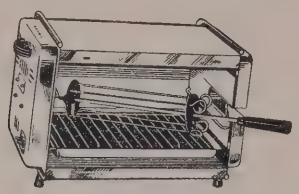
NEW PRODUCTS: LATEST RELEASES IN ELECTRICAL AND ELECTRONIC EQUIPMENT

This section of our paper is reserved for the introduction of new products and space preference is given to our regular advertisers. For further particulars contact Advertising Manager, R. & E., Box 8022, Wellington.

RADIO (1936) LTD. NEW RELEASES

Three new home appliances are about to be released on the New Zealand market by Radio (1936) Ltd. These appliances have been designed to satisfy many needs in the home, and those interested in labour-saving and time-saving equipment will find these new appliances of great interest.

GRILLFIX BARBECUE



This is an exciting new infra-red griller appearing for the first time in New Zealand. Precision-built by German engineers, the Grillfix combines all the delights of outdoor barbecue cooking with the convenience of indoor facilities of the modern home.

A motor-driven rotating spit holds everything from a chicken or steak to shaashlik kebabs or skewer dishes. In addition, there is a tray for standard grills. This type of appliance, which has taken the U.S.A. and the Continent by storm, produces food that is tangy, tasty, and different. It will be a valuable addition to the electrical equipment of the modern home.

Specifications:

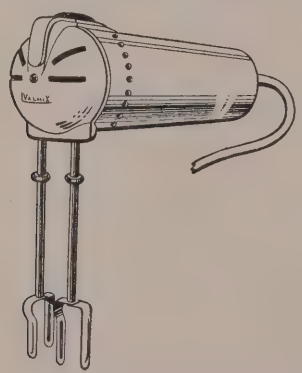
The Grillfix is 22 in. wide, 11 in. high, 11 in. deep.

Rating: 1,350 watts 230 volts.

Price: £32 10s.

Distributed by Radio (1936) Ltd., P.O. Box 1166, Auckland.

VALMIX ELECTRIC HAND-MIXER



A low-priced, top-quality electric hand-mixer is an appliance that all housewives will desire. The larger food-mixer is often too cumbersome for a small beating job, and that is where the Valmix is pre-eminent.

It features stainless steel beaters of the open-end type (which have been proved superior to the old looped type) and they are easily removable. The Valmix will whip, beat, mix, fold, and mash, and within its capabilities is a thoroughly reliable hand-mixer that will give long service.

The Valmix, which comes from England, has a moulded body, designed to give a comfortable grip, and has a thumb switch for easy control. It will fit any kitchen bowl and is so easy to use that it can be taken to the job rather than take the job to it. Safe and economical, it is designed to serve and save in the home.

Specifications:

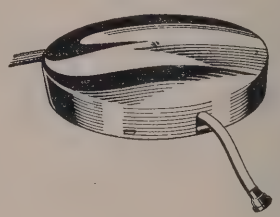
Weight: 1½ lb.

Rating: 45 watts 230 volts.

Price: £5 19s. 6d.

Distributed by Radio (1936) Ltd., P.O. Box 1166, Auckland.

FRESHETTE



This is an ingenious English invention for restoring garden freshness to wilted vegetables and flowers. In action, it is as amazing as it is simple. Operating from town water supply, it extracts stale air and gases from partially dehydrated vegetables and replaces, in the vegetable cell, the moisture lost through dehydration.

Limp vegetables regain vitality, resulting in firmer texture and improved taste. The Freshette is built for lifetime service and has no moving parts to wear out. Running costs are negligible.

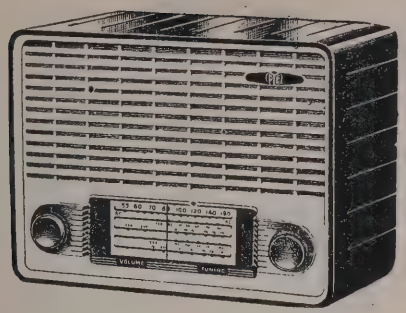
It is excellent value at 79s. 6d.

Distributed by Radio (1936) Ltd., P.O. Box 1166, Auckland.

* * * *

PYE MODEL "45"

Every Pye dealer, and probably everyone in the trade, will be familiar with the now famous Pye Model Y. This outstanding 4-valve model in the plastic cabinet has exceeded all expectations of sales; it has been a steady favourite now for several years.

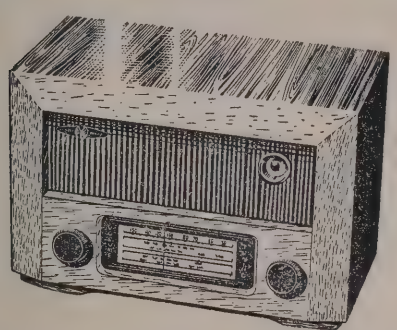


Pye have designed the new model "45" to replace model Y. No change has been made in cabinet design (in view of more than satisfactory sales none was thought necessary) but an extra valve has been added, to make the "45" a five-valve model. The quality of reception and reproductions, and general all-round performance have been greatly enhanced by this change, yet the retail price is only £18 18s.

Just as a reminder, here are the facts about the "45": 5-valve, broadcast for A.C. operation; 6 in. x 4 in. heavy duty magnet elliptical loudspeaker; illuminated dial scale; plastic cabinet in mottled walnut with ivory grille. The "45" looks well, sounds well and will sell well. The price again—only £18 18s.

* * *

PYE MODEL "85"



Brother to the old model Y was the "74" in a handsome oak cabinet, and model "74" is now receiving the same treatment as the "Y."

With the addition of another valve, as well as its magic eye, the popular "74" is being re-issued as Pye Model 85. Again there is no change in the cabinet design, but the general improvement in performance is most marked.

Specifications for the new "85" are the same as those for the Pye "45" with the addition of the "magic-eye". Cabinet, as we mentioned, is solid oak and is available either light or dark.

Pye radios and radiograms are distributed throughout New Zealand by Pye (New Zealand) Ltd., P.O. Box 2839, Auckland.

* * *

CLIPPER MODEL 513

Model 513, one of the newer additions to the Clipper range, boasts one of the neatest and brightest plastic cabinets we have seen in this country. Its lines are attractive without being extravagant, and we doubt if there's a room in any home where the 513 would look out of place.

Colour: Rich, creamy ivory with chromium grille and matching tuning knobs.

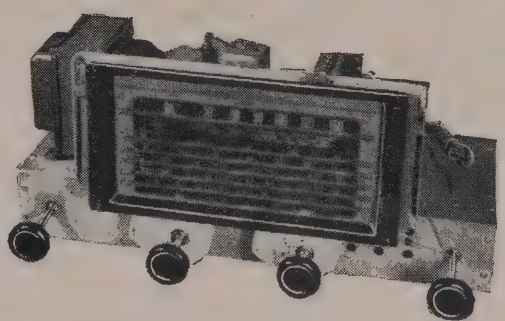
One outstanding feature of the Clipper 513 is the fine tonal reproduction gained from its 6 in. x 4 in. oval speaker and five powerful valves. A neat switch provides clear tone control which is amplified by the excellent acoustic properties of the moulded plastic cabinet. A clear dial with a colourful and easily read scale makes for easy tuning.

We feel that turnover should be fast at the customer-conscious retail price of £18 10s.

Clipper radios and radiograms are distributed throughout New Zealand by G. A. Wooller and Co. Ltd., Head Office, Box 2167, Auckland, and branches at 43 Lower Taranaki Street, Wellington, and 604 Colombo Street, Christchurch.

* * *

INDUCTANCE SPECIALISTS LTD.'S NEW "HAM" BANDSPREAD BASIC KIT, TYPE B/10, INCORPORATING BANDSPREAD ASSEMBLY, TYPE 94



Manufactured by Messrs. Inductance Specialists, Ltd., of 157 Thorndon Quay, Wellington, the type P94 assembly provides a tuning unit capable of giving outstanding performance. It is sound in basic technical design, simple to adjust, accurate, and almost linear in bandspread frequency calibration. Dial calibration gives main marking spaced 100 k/c. apart, and subdivided into fractions thereof.

"Poly Q" adjustable slug coils are incorporated throughout, and are tuned by a special split stator tuning condenser. The oscillator circuit is temperature compensated by negative and positive coefficient condensers, in suitable relationship. Special iron cores are used to facilitate alignment and provide a high degree of frequency stability.

The bands, 80, 40, 20, and 15 metres are fully spread, and provision is made to substitute a 160/80 metre band in place of the fully-spread 80-metre band.

Dial calibration is accurate immediately upon switching on, and remains substantially constant, free from drift over very wide variations in temperature. Bandspread frequency ratio remains constant on all bands.

The A.V.C. circuit is arranged to vary the time constant according to the operating frequency, and, on the higher frequencies, the shorter time constant greatly improves reception by rapidly compensating for fading signals.

A special high-gain aerial coil is used on the broadcast band to assist in providing a high signal-to-noise ratio.

Dial movement and scale incorporates high-ratio ball-bearing spin-wheel drive, attractive floodlit scale with additional 0-100 linear logging scale, and band and circuit indicators. The dial movement is completely isolated from the tuning condenser, resulting in quiet, effortless tuning, free from mechanical and electrical frictional noises.

Assembly is designed for converter tube, type ECH21, and is supplied as basic kit, type B/10, completely assembled and wired up to and including the converter tube. It is accurately aligned on all bands by crystal-controlled test equipment.

A spare two-pole, five-position wafer is fitted to front of assembly, and may be used for any desired purpose.

Band Coverages

Band 1: Broadcast 535 k/c. to 1,700 k/c. (Switch fully, clockwise.)

Band 2: 80-metre band 3.5 m/c. to 4 m/c.; or 160/80-metre band 1.6 m/c. to 4 m/c.

Band 3: 40-metre band 6.96 m/c. to 7.44 m/c.

Band 4: 20-metre band 13.9 m/c. to 14.9 m/c.

Band 5: 15-metre band 20.9 m/c. to 22.3 m/c.

Basic Kit Type B/10 comprises:

(1) Tuning assembly, type P94.

(2) Tuning condenser. Special low-loss split stator.

(3) Dial movement and scale, type D/5-MK1-SC/15. A handsome slide-rule type, with ball-bearing spin tuner and floodlit scale. Accurate frequency calibration, logging scale, and band and circuit indicators.

(4) Chassis type 57. A sturdy 9-valve chassis in plated steel, 16 in. x 6½ in. x 2½ in; — 18g. Designed for a 125 m/a. power supply and with sufficient clearance for large type output tubes (6A3), etc. I.F. transformer position arranged to provide easy switching from front when variable band width transformers are used.

(5) R.F. and converter tubes and associated wiring and parts.

Note.—Dial escutcheon, type P57, in Florentine bronze is also available, but is not supplied with basic kit and must be ordered separately.

Retail price, including valves and packing, £21 12s. 4d.

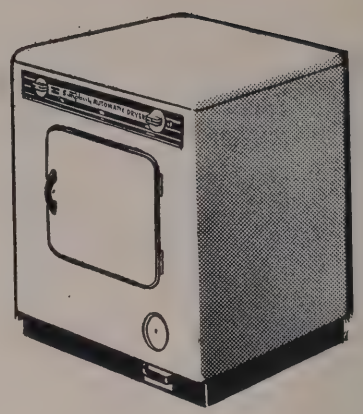
Obtainable from Inductance Specialists Ltd., 157 Thorndon Quay, Wellington, or their stockists throughout New Zealand.

* * *

MISS SIMPLICITY AUTOMATIC ROTARY CLOTHES DRYER

A boon to housewives at any time, and especially now that the winter has come, is the new Miss Simplicity Automatic Rotary Clothes Dryer, marketed by A. R. Harris Company Ltd., of 74-76 Manchester Street, Christchurch.

The Miss Simplicity employs a simple and efficient suction drying system which gives greater air circulation, higher evaporation rate per hour, and faster drying than any other dryer. It keeps the dryer comfortably cool at all times and eliminates the need for insulation and the intricate sealing of seams and cracks which is so essential with the "pressure" system used in other dryers. The capacity is 8 lb. dry weight (approximately 16 lb. of wet clothes); toss in a full load of clothes, just as they come from the wringer or spinner tub of the washer.



Special features include a well-protected radiant heating element which extends right across the top of the cylinder, spreading an even heat over a large area. Infra-red rays from the heater assist evaporation and also act as an efficient germicidal lamp. Two safety thermostats built right on to the heating unit automatically switch off the heating element if the temperature should happen to go up to 210° F. Then, when it cools, they automatically switch on the heat again.

The simple and easily operated automatic controls switch off the heating element when the clothes have reached the desired degree of dryness, and the dryer may be stopped at any time by turning off the main switch on the front panel. The vis-a-port enables the operator to see if the heating element is on or when it goes off automatically for the cooling cycle.

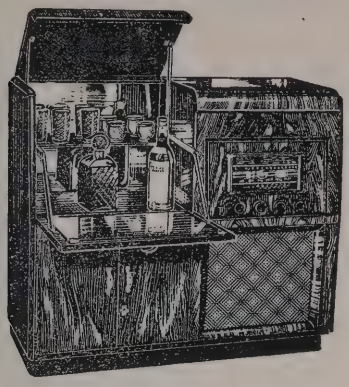
A 16 in. diameter opening in the 26 in. x 18 in. cylinder permits easy loading. The cylinder itself is made from bonderized steel with a baked aluminium rust-resistant finish, and is completely perforated to permit the most efficient air circulation. So smooth is the finish that there is less wear and tear on clothes than on a clothes-line in a breeze. Its gentle action tumbes the clothes over and over evenly and slowly 48 times every minute. The lint trap, which has more capacity than on any other dryer and prevents overloading, is easily removable and requires cleaning daily only under normal operation.

Occupying a floor space of only 30 in. x 24¾ in., with a convenient table height of 3 ft., the Miss Simplicity Drier is finished in gleaming white, durable baked enamel.

With a sturdy high torque electric motor rubber mounted with "V" belt drives for quiet, vibration-free operation, the Miss Simplicity operates on 230 volts A.C., either single or two-phase as required.

Trade inquiries should be addressed to A. R. Harris Co. Ltd., 74-76 Manchester Street, Christchurch.

LUXURIOUS IN APPEARANCE AND PERFORMANCE
THE H.M.V. "BERKELEY" RADIOGRAM AND COCKTAIL CABINET



This luxurious instrument well justifies its description, since nothing has been omitted which experience and ingenuity could devise to include in its beautiful walnut veneer cabinet.

The dual-wave radio provides truly lifelike listening, while the three-speed gramophone incorporates a Monarch record changer capable of playing up to ten discs, mixed or uniform.

The crystal pick-up is of special design to give the best possible reproduction of standard or microgroove recordings.

Selection of the appropriate turntable speed is accomplished by a single change-over switch. The cocktail cabinet incorporated in the H.M.V. "Berkeley" is mirror-lined and opens and closes on a push/pull system.

A twelve-inch speaker gives extremely good sound relaying at generous volume; the tone controls are sensitive and selective, and the edgelit tuning scale enables rapid station identification.

Specifications

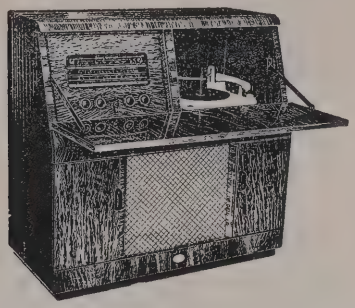
Type Set: Dual-wave superheterodyne, with gramophone switching in third position of wave-band switch.
Power Supply: 230 volts 50 c.p.s. 65 watts.

Tuning Range: B.C., 535 k/c. to 1,600 k/c.; S.W., 5.95 to 19 m.c..

Speaker: 12 in. Rola.

Mirror-finished cocktail cabinet. Specially designed chrome supports for opening on a push/pull system.

MASTERPIECE OF MUSICAL REPRODUCTION
HIS MASTER'S VOICE 11-VALVE "SUSSEX" RADIOGRAM



The "Sussex" radiogram represents H.M.V.'s latest distinguished achievement in musical reproduction, radio reception, and recorded music with vivid, true-to-life tonal purity never before imagined.

The "Sussex" radiogram is a magnificent example of advanced engineering in radio . . . it provides you with the pick of the world's broadcasts . . . enables you to play up to ten standard or mixed recordings on its faultless three-speed record changer, the pick-up of which is fitted with a special crystal for high-fidelity reproduction . . . and is a beautiful piece of furniture, being finished in highly figured walnut veneer.

Specifications

Model 5411 AW/C.R.G.

Voltage Range: 230 volts A.C.
Consumption: 90 watts.
Speaker: 12 in. circular Rola, permanent magnet, 15-watt output.

Pick-up: High-fidelity lightweight.

Trade inquiries to His Master's Voice (N.Z.) Ltd., Head Office, 162-172 Wakefield Street, P.O. Box 296, Wellington.

Letter to the Editor

(Continued from page 23.)

end of the winding to earth. The loop coil is then wound immediately over the last layer of primary turns. One solved this difficulty with a larger core and former, to ensure that the loop was physically adjacent to the earth end of the primary.

In conclusion, thanks for an excellent tuner, which I find far superior to any other I have built.—I am, etc.,

B. S. FURBY.

N.Z. RADIO TRADER'S FEDERATION

Preceded by a happy social foregathering on 21st and 22nd May, the business session of the Annual Conference of the New Zealand Radio Traders' Federation was held at Nelson on 23rd May. A full report of the proceedings and findings will be published in our July number.

In the meantime, a brief mention of some of the matters discussed at the executive meeting on 20th April may be of interest.

After reviewing the unsatisfactory position concerning radio interference, it was resolved that a recommendation be forwarded to the Annual Conference for a deputation from the Federation to approach the Minister stressing the need for immediate action in this matter.

It was reported that, owing to unforeseen circumstances, printing of the "Trade-in" handbook had been seriously delayed, but it was expected that this would be available shortly.

After the reading of advice from the Minister that the Post Office was not prepared to discriminate between the bona fide dealer and any other who wished to take out a dealer's licence, further discussion on this matter was deferred for consideration by the Annual Conference.

Findings of the Board of Trade Inquiry into the supply of condensers had been delayed pending the presentation of factual evidence by the Federation. Inquiries were to be made of the Board as to whether its findings would be available for consideration at the forthcoming Conference.

It was reported that the broadcasting authorities were well aware of the serious interference in Christchurch caused by adjacent channels during national hook-ups, and that, in co-operation with the Post Office, they were endeavouring to effect improvements. Although there were still certain engineering difficulties to be overcome, considerable improvement had been effected since the introduction of high-fidelity lines, and it was hoped that such improvements would continue.

On behalf of the Federation, Messrs. N. J. Hallett and N. Souper accepted an invitation from the Wellington Technical College to inspect its workshops.

Advice was received from the Board of Trade concerning its inquiry into import duties and/or import licensing of electric batteries, both dry and wet, which is to take place on 14th June, 1955.

Returns of radio licences in force at 30th September, 1954, showed a total of 511,114—an increase of just on 9,000 compared with those in force at the same period of the previous year.

The following remits for consideration by the Annual Conference were approved:—

From Taranaki Association

"That the Federation approach the necessary authorities to press the P. and T. Department to implement the present regulations or have further stringent measures passed to prevent the importation or manufacture for sale of all portable or stationary electrical appliances likely to create radio interference."

A similar remit was received from the Wellington Association.

Remit from the Wellington Association

"That the New Zealand Federation be requested to approach all power boards asking them to stabilize their voltages at the standard rates for New Zealand —namely, 230v., as it appears that, in many cases, the public are receiving either a greater or lesser voltage, to the detriment of electrical appliances which are manufactured for the standard 230v."

Arising from the Wanganui Association's submissions to the Wanganui-Rangitikei Electric Power Board, considerable discussion ensued on the matter of power board trading, and it was resolved that this subject be referred to the Annual Conference and that an invitation be extended to the Electrical Contractors' Association to attend the Conference in order to discuss this matter.

* * *

ANNUAL REPORT

The following is a copy of his annual report presented by Mr. N. Souper, President, to the Annual Conference of the New Zealand Radio Traders' Federation at Nelson on 23rd May, 1955:—

"The main problems of the Federation were those of electrical interference, importation of condensers, and power board trading.

Trading Conditions

"Once again the trade has experienced another successful year. There has been a plentiful supply of goods with extremely keen competition. The public now has a comprehensive range from which to choose, and this, coupled with the competition amongst manufacturers to produce a cheap set, has, to a large extent, made our members realize that today is a buyer's market. Thought should be given to the question of discounts on the smaller sets; any further curtailing of discounts could make such sets an uneconomical proposition.

Accredited Dealers

"The Federation compiled a list of accredited dealers, and members are advised to allow discounts only to those whose names appear on these lists. Wholesalers and manufacturers are asked in particular to honour this list. The Federation is continually receiving complaints in this regard.

Apprenticeship

"Two years ago the Federation, in conjunction with the New Zealand Radio and Television Manufacturers' Federation, issued a leaflet in an endeavour to attract youths to the industry. These leaflets have undoubtedly proved their worth, as instanced by the increased number of apprentices in the industry today.

Electrical Interference

"This is a matter that has caused members considerable concern. Every possible step has been taken by our representative on the Standing Committee to secure some action, but so far his efforts have been unavailing. Our thanks are due to Mr. D. Billing in this regard. Through the courtesy of the Hon. Minister, Mr. Milne, of the P. and T. Department, will address the meeting on the future policy of the Standing Committee.

(Concluded on page 53.)

TRADE WINDS

RADIO (1936) LTD.'s SUCCESSFUL SALES CONFERENCE

Recently, Radio (1936) Ltd. held a most successful sales conference in Auckland. Such personal contact with its field representatives has many advantages and results in the latter obtaining a more intimate knowledge of the great range of Ultimate products. Indeed, a valuable exchange of opinions and ideas has stimulated all concerned.

Company representatives from all over New Zealand were most interested to review the present range of Ultimate products, the largest of its kind in the country. They were also delighted to hear of plans for the extension of that range by means of new models shortly to be released, and to see some of the equipment which will be available to the public in the near future.

In the field of intercommunication, the easy-to-install and versatile Moderncom equipment aroused great interest. Other new appliances included the Valmix electric hand-mixer, the Freshette vegetable freshener, and the Grillfix infra-red electric barbecue griller.

National advertising was fully discussed and general plans made to support the great team of Ultimate dealers. The recent agreement between E. K. Cole Ltd., of England, and Radio (1936) Ltd. has opened up vast possibilities. New Zealand will benefit greatly from the association of the two companies, and will soon see such famous products as Eckovision television receivers and Thermovent heating equipment which has given such excellent service in the liners "Queen Mary" and "Queen Elizabeth."

Opportunity was taken to familiarize the representatives with the new products, only a few of which have been mentioned. As the Conference was held over the Easter period, the big Auckland Easter Show made instant appeal to the visitors. Special interest was taken in the Radio (1936) Ltd. stand by representatives and the general public. The puppets which demonstrated Ultimate products played to admiring and appreciative audiences, which voted both products and entertainment as "Tops."

Altogether, this proved a most successful conference which will be of much benefit to the public of New Zealand.

WHIRLPOOL PRICES DOWN

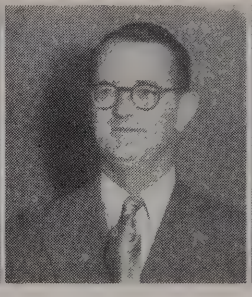
J. A. P. Scott Ltd. announce a new low price of £59 18s. for their Whirlpool washing machine.

The 10 Star Whirlpool has proved extremely popular with dealers and public alike, and sales continue at a consistently high level. This is not surprising as Whirlpool, in America, is one of the world's largest manufacturers of washers, dryers, and ironers.

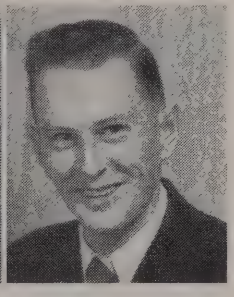
Mr. J. T. Sinel
Hamilton

Mr. M. A. Inkster
Wellington

Mr. G. M. Bowles
Tauranga



Mr. J. D. Gray
Palmerston North



Mr. G. D. Hyde
Whangarei

CHANGE OF ADDRESS FOR PYE (N.Z.) LTD. AND G. A. WOOLLER & CO. LTD., WELLINGTON AND CHRISTCHURCH

Messrs. Pye (N.Z.) Ltd. and G. A. Wooller and Co. Ltd., announce that their new Wellington address is 43 Lower Taranaki Street, while at Christchurch their address is 604 Colombo Street.

* * * *

N.Z. ELECTRONICS INSTITUTE (INC.)

At a recent Council Meeting of the New Zealand Electronics Institute, the following were admitted to membership:—

A. Swan, Theo de Grauw and N. W. Anderson, all of Dunedin.

* * * *

VISIT OF ANTIFERENCE LTD. EXECUTIVE

Mr. Norman M. Best, Managing-Director of Antiference Ltd., accompanied by his wife, recently paid his first visit to New Zealand. While the trip was of extremely short duration, and business time was further reduced by the observance of the Anzac Day holiday, Mr. and Mrs. Best were able to see something of our New Zealand scenery, including the thermal activities at Rotorua and Taupo, and both were most impressed by the New Zealand countryside.

The primary reason for Mr. Best's visit to this part of the world was to complete manufacturing arrangements in Australia for Antiference equipment, in particular, television aerials, to coincide with the requirements for these products after the inauguration of the television service in Melbourne and Sydney towards the end of 1956.

As one would expect, our visitor was enthusiastic about the development of television, and he indicated that whether New Zealand finally adopts either vertical or horizontal polarization, Antiference equipment will be available to meet the situation.

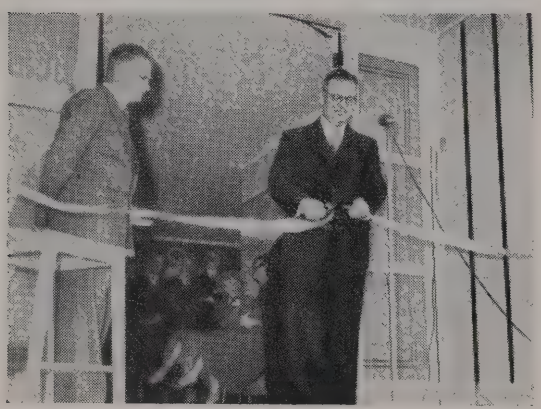
Not only are Antiference Ltd. the largest manufacturers of radio and television aerials in the Commonwealth, but they are foremost among the British manufacturers who establish new factories in member countries as the need arises.

Next country on Mr. Best's itinerary is Canada, where his subsidiary company, Antiference (Canada) Ltd., of Toronto, is undergoing further expansion and removing to new and larger premises.

Host to Mr. and Mrs. Best during their New Zealand tour was Mr. William Young, of Russell Import Co. Ltd., New Zealand representative for Antiference Ltd.

* * * *

OPENING OF THE DOMINION RADIO AND ELECTRICAL CORPORATION'S NEW FACTORY AT AUCKLAND



Mr. J. D. Murdoch, Mayor of Otahuhu, is shown above cutting the ribbon while making the opening statement.

"I will cut this ribbon and declare that this fine and outstanding project is now open and in full swing for the benefit of Otahuhu and New Zealand."

Following the official opening, the gathering moved through to enjoy the refreshments, which were in keeping with the festive atmosphere. An excellent afternoon tea had been tastefully laid out in a section of the factory which was appropriately decorated.

During the afternoon tea, Mr. T. R. Gobby, Manager of D.R.E.C.O., took the opportunity of presenting to Mr. Murdoch the first PHILCO off the production line at the new factory.

Messrs. Henderson, Don, Wharfe, and Whatnall participating in festivities.

Mr. Gobby handing over PHILCO "MONTANA" to Mr. J. D. Murdoch.

Special entertainment had been arranged for the staff, and the many happy faces which are familiar to those who visit DRECO could be seen to be even more happy than usual as the evening wore on.

It was indeed a memorable day for the staff, although subsequent inquiry revealed that some memories required even a little prompting on the following day as to what had actually transpired during certain stages of the festivities.

N.Z.A.R.T. Notes

(Continued from page 30.)

but also of life. Though you may play round with far more lethal voltages than are available in the mains, this is no excuse, and we expect amateurs to set a good example to all other classes of radio experimenters. It cannot be sufficiently emphasized that every amateur should ensure that his mains wiring is above reproach. Remember, "A DEAD HAM IS NO EARTHLY USE."

CLASSIFIED ADVERTISEMENTS

Rates 4d. per word, minimum charge 3s. Deadline date 1st of month preceding publication.

RADIO ENGINEER'S COURSE

Correspondence Course specially compiled to meet New Zealand Examination Syllabus. Free prospectus.

NEW ZEALAND RADIO COLLEGE

26 HELLABY'S BUILDING - - - AUCKLAND, C.1

AROUND AND ABOUT

AUTOMATIC PRODUCTION OF SAPPHIRE STYLI

Sapphire Bearings Ltd. expect to increase their output of sapphire styli for gramophone pick-ups to 20,000,000 per year by this coming June, after they have moved to their new 10,000 sq.ft. factory at Bletchley, Bucks. The present output of 10,000,000 is being obtained from a factory not much larger than a large drawing-room, with fifty people working in 24-hour shifts, and the firm claims to have captured the world market in sapphire styli, formerly held by the Swiss.

Now the British company exports more than all the Swiss industry combined, and has cut costs by a full 75 per cent. Shortly it will be going after the watch and instrument jewel market, at present held by the Swiss, who manufacture 600,000,000 jewels a year.

The old method of making a sapphire stylus was a three-stage manual operation, with separate grindings for cone cutting, polishing, and radiusing the spherical tip. In the automatic process used by Sapphire Bearings Ltd., machines grind the cones at the rate of six points per minute, and radiusing and polishing are done in a single tumbling operation in batches of 50,000 to 100,000 without labour.

The company has also pioneered the development of flame-fashioned styli, in which the point is formed at a temperature of more than 2,000 deg. C., and this, too, can be done in batches. The surface produced in this way is so smoth and polished that no departure from perfect smoothness can be measured.

* * *

PYE-TECHNOGRAPH AGREEMENT

Technograph Printed Circuits Ltd., holders of more than 100 patents for the manufacture of printed electrical circuits, announced recently an agreement with Pye Ltd. which will enable Pye to use the printed circuit technique.

This arrangement is non-exclusive, and developments in the printed circuit field will be available to the whole industry. At present, negotiations are in progress with several large manufacturers, and licences have been granted to the Telegraph Condenser Co. Ltd., which already produces a number of applications of this type of circuit. T.C.C., in addition, has an exclusive licence in Britain to develop the application of printed circuit techniques to capacitor manufacture.

The Pye agreement will mean that the whole of Pye's experience and knowledge of electronic work and production will be made available to Technograph.

E.D.A. ADVERTISING FILMS

Top stars, including Arthur Askey, Cicely Courtneidge, Sally Ann Howes, and Jack Hulbert, have been employed by the British Electrical Development Association in its new advertising films to boost the use of electricity for cooking purposes in Britain.

"Before Your Very Eyes" is a technicolor film combining live-action and cartoon work, and featuring Arthur Askey and his "wiser self" (a cartoon). Askey is seen with an old-fashioned cooker, when his "wiser self" appears and advises him to scrap his old kitchen. He conjures up a new electric cooker and demonstrates its advantages, including the automatic time switch. It is suggested to audiences that new electric cookers can be seen at local electricity showrooms.

Other new E.D.A. films include "Willing Does It," an 18-minute film on kitchen planning for architects, and "Bride and Prejudice," a cookery film with a running time of 34 minutes. Both are in colour.

* * * *

RUSSIAN COMPETITION WITH VIENNA'S ELECTRICAL DEALERS

From a British contemporary journal we learn that Russian-operated stores, selling cut-price electrical goods from Eastern Europe, have become a regular feature in recent times of the Soviet Sector of Vienna, competing vigorously with local dealers.

The principal establishment is situated on the ground floor of a large office block requisitioned for use as the Soviet Information Centre. There, located in the busiest district of Vienna, a departmental store ranges round two sides of the office block, and has even expanded to premises across the road.

Under the general heading of "Technical Products" the store sells radios for five to ten pounds, electric sewing-machines, hair-driers, electric razors, irons, and vacuum cleaners. The majority of the goods originate from the Soviet Zone of Germany, though others come from Russia itself.

All prices are considerably below those current elsewhere in Vienna. However, the reason is obvious, as the Russians, as occupiers, pay no taxes or import duties. Operating from requisitioned premises, they also pay no rent—even though their main store is close to Vienna's most expensive shopping centre. In addition, the propaganda value of selling cut-price equipment probably far outweighs any possible financial loss that might be incurred.

It is reported that the quality and finish of the goods have no great reputation, but the sheer cheapness attracts many customers who are not necessarily sympathisers with the Russian occupiers.

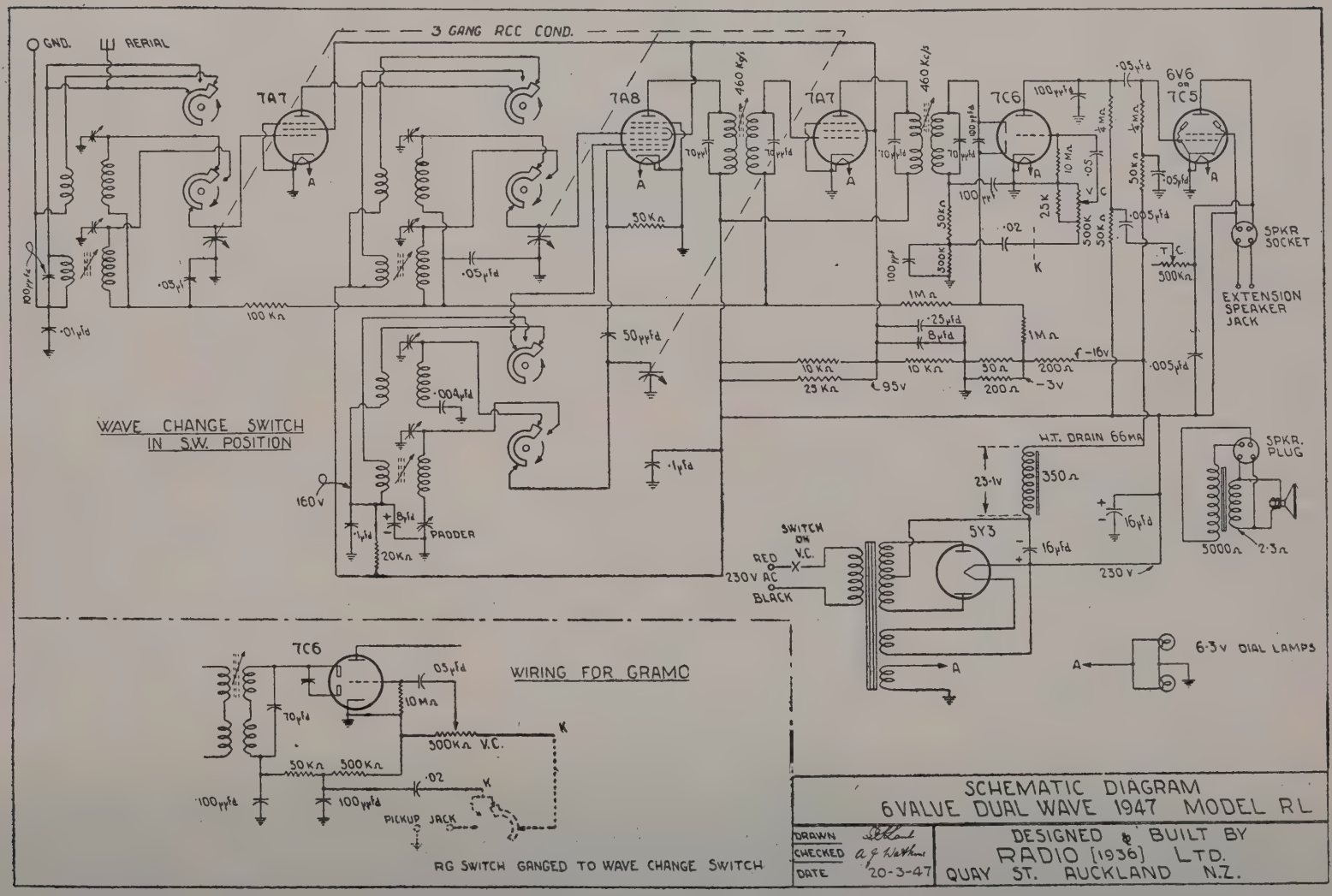
* * * *

TELEVISION FOR ATOMIC PLANT

Television techniques are proving increasingly useful to industry. Atomic scientists of the United Kingdom Atomic Energy Authority recently wanted information on the conditions obtaining in a reactor which had been in service for some years. Direct observation was impossible owing to the intense radioactivity, even when the reactor was shut down for maintenance.

However, a Marconi industrial television camera, suitably protected, provided the answer. Its small size, 5¼ in. x 4 in. x 11⅜ in., enabled it to be inserted through a narrow conduit to the interior, whence it televised pictures over a closed circuit to monitoring equipment installed at a safe distance. Thus, for the first time since the reactor was built, the operating staff was able to see the exact condition within.

For the Technician: THE ULTIMATE MODEL RL



MISSING AND STOLEN RADIOS

AUCKLAND:

MULLARD Model 402, Serial No. 52559; oblong plastic cream cabinet, 12 in. x 6 in., with one brown knob and second knob missing.

AUTOCRAT 8-valve car radio; separate speaker and radio; mottled dark brown cabinet, 5 in. x 12 in. x 2½ in.; bakelite front; two knobs under dial.

ARIEL 7-valve car radio, Serial No. 3416, single unit, brown metal cabinet 8 in. x 12 in. x 4 in.; two white tuning knobs; electroplated rim round dial.

AUTOCRAT 8-valve car radio, Serial No. 12370 in two units; two tuning knobs, horizontal dial, brown crackle finish; two home-made brackets fitted for attaching to dashboard.

AUTOCRAT 6-valve battery/electric car radio, Serial No. 10333; Wanaka grey metal case, 9 in. x 9 in. x 6 in., with chromium carrying handle.

PUTARURU:

MULLARD battery/electric 5-valve portable, Serial No. 50645, Model 681.

ROTORUA:

AUTOCRAT car radio, Serial No. 14883.

GISBORNE:

MULLARD battery/electric 5-valve portable radio, Model 681, Serial No. 50745; green plastic cabinet with white latticed front; tuning and volume knobs inset in front, A.C. knob inset in side.

WAYFARER 6-valve single-unit car radio, Type 12, Serial No. 2579; brown wrinkled metal case with "MAX GUNN RADIOS" and "874" in black and gold transfers on rear of case.

NATIONAL PARK:

H.M.V. mantel model, brown wooden veneer case, 6 in. x 4 in., with upright dial on left-hand front and deep gouge mark on back.

PALMERSTON NORTH:

ULTIMATE table model, Serial No. 23402, walnut veneer cabinet, with square-shaped dial and three knobs in front.

WELLINGTON:

AUTOCRAT 12-volt car radio, Serial No. 14963; brown enamel case with two white tuning knobs on front.

H.M.V. "Radiomobile" car radio, Model 324, Serial No. 30612.

STATE 6-volt 7-valve car radio, Serial No. 156160/50662.

COLUMBUS 12-volt car radio, Serial No. 86470; brown cabinet with two brown tuning knobs.

ULTIMATE dual-purpose 6-valve portable, Serial No. 167-488; brown plastic case.

LOWER HUTT:

PHILIPS portable, broadcast battery radio in Australian-made grey steel cabinet, 12 in. x 4 in. x 6 in.

CHRISTCHURCH:

COURIER battery/electric portable, 24 in. x 18 in.; three knobs.

CLIPPER 5-valve dual-wave mantel radio, Model 524, Serial No. S/N 53756; cream and red case.

STARLITE bedside radio, Serial No. 31948; white cabinet with clips for attaching to bed.

INVERCARGILL:

PACEMAKER portable radio, Model 5153 AB, Serial No. 31100A; light green cabinet with white dial cover and handle.

RADIO RECOVERED

REGENT radio stolen from PETONE.

How to Capitalize on Lost Sales

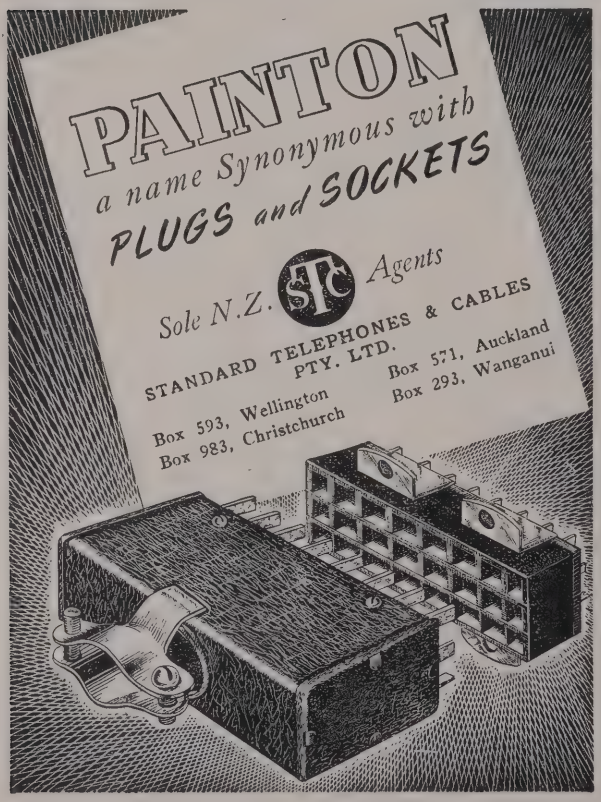
(Reproduced from "Broadcast," Vol. 2, No. 3)

Customers who buy elsewhere after a stiff sales battle seldom return voluntarily—but there is a way to get them back into the fold. *Follow up those lost sales!* This may be a bizarre bit of advice, but it is sound. You may have lost *that* sale, but you need not lose a prospect of selling there some other time. In any case, you can prevent other lost sales by following up and finding out *why* you lost out.

Look at it this way. You, as a salesman, spend a lot of time and effort trying to sell a prospective customer a product running into several pounds. Since you are no more of a world-beater than the rest of us, you lost the sale. And, you stand a chance to lose the prospective customer for all time, too. The odds are all against such a prospect voluntarily returning to you.

Why? Because, as a rule, they are sort of squeamish about facing you again. Put yourself in such a person's position. You took up a lot of the salesman's valuable time. He used a lot of benzine in his car for you, and in the end you didn't do business with him. You signed up with a competitor who had what you considered a better deal to offer. So you feel sort of guilty thereafter every time you pass him or his shop. Perfectly natural, too. Once in a while a person, quite different from the rank and file, will drop in and say, "I am sorry, Mr. F . . ., but I got just what I wanted from so-and-so. I want to thank you for the time and trouble you took with me." We all mean to act like good sports as prospective customers when we switch our business, but so few of us get round to it.

However, there is a silver lining to lost sales. The losing salesman always comes out of the deal with a potent something. That *something* is the customer's *name and address*. Having such information, the salesman can follow up the lost sale—and he can accomplish several things in so doing. For example, he can convince the prospect that he, the salesman, is a good sport—can lose a clean fight without batting an eye. Secondly, he can do away with the prospect's "guilty conscience" and make the latter feelt like revisiting his shop. Lastly, such visits reveal reasons why the prospect bought elsewhere.



Record Talk

(Continued from page 32.)

complete numbers, not the sort of "musical switch" of former days), and Bing Crosby is heard in a galaxy of Gershwin songs on LA 8666. Victor Young's record of "Love Themes from Motion Pictures" (LA 8672) will have its eager public, too. Among the popular Deccas, pride of place goes to a delightful one of Irish traditional songs presented by the experienced ballad singer Richard Hayward, with orchestra under Roy Robertson. The items have been arranged so as to form a tasteful programme, and the disc is called "Irish Saturday Night" (LF 1164). A 12-inch collection of light pieces played by Robert Farnon's Orchestra is offered under the title of "Flirtation Walk" and contains thirteen other tunes as well as the one of the title (LK 4083).

The serious side of the Decca list comprises mainly a re-issue of works, previously contained on two sides of a ten-inch disc, but now accommodated on one side of a 12-inch, which is a good idea provided you want both works so coupled. At any rate, Campoli's performances of concertos by Mendelssohn and Bruch are newly coupled on LXT 2904 (the Bruch was formerly paired, most unsuitably, with a Bach unaccompanied sonata). Ansermet conducts Stravinsky's Firebird Suite and his Symphony of Psalms (LXT 2916), and the Byrd four-part and five-part Masses, by the Fleet Street Choir, are on LXT 2919. The orchestral attraction is the first release here of an early Richard Strauss fantasia, "Aus Italien" "From Italy"), played by the Vienna Philharmonic under Krauss on LXT 2917. This is the work in which Strauss innocently quoted Denza's "Funiculi Funicula" under the impression that it was an Italian folk-song. The London Oiseau Lyre series this time includes two most attractive flute concertos by Karl Stamitz (OL 50035), two early Mozart symphonies, Nos. 27 and 30 (OL 50039), and three Haydn trios for flute, violoncello, and piano (OL 50036).

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10 and 6-Metre Converter

(Continued from page 26.)

the grid circuit. It will be seen that oscillator voltage is derived from a 1000-ohm resistor in the plate lead of the Clapp circuit, and is coupled to the mixer by a 10 $\mu\mu$f. condenser. Provision has also been made for varying the oscillator output by alteration of the screen voltage on the oscillator tube. This is done by the use of a variable dropping resistor, with a 15k. resistor in series. The range of control is not as great as one might expect, because the screen current is quite small, and so a large variation in screen resistor does not produce a very wide variation in screen voltage. However, the variation is sufficient to enable the best results to be obtained. In any given built-up version of the circuit, the pot. could no doubt be dispensed with, but variations in construction can easily result in variations in oscillator output, and this will show up as variation in conversion conductance of the mixer. As sensitive a meter as can be obtained should be connected in series with the mixer grid leak, and the grid current measured as the oscillator screen control is varied. It is essential that too much oscillator voltage should not be supplied to the mixer grid, because too much spoils the flavour, as it were, and reduces the conversion gain just as surely as too little. No more than 20 μamps of grid current should be shown when the converter is properly aligned, with all circuits tuned to frequency. Tuning the oscillator will be found to produce a large increase in mixer grid current when the frequency approaches the signal frequency. This is of little importance, for the adjustment of oscillator output should only be made when all circuits are on their proper frequencies. A range of grid current from 5 to 20 μamps of grid current is permissible.

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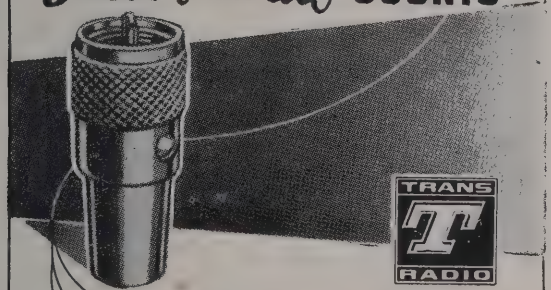

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PUBLICATIONS RECEIVED

From Amalgamated Wireless (Australasia) Ltd.:
"Aerial," January, 1955.
From Amalgamated Wireless Valve Co. Pty., Ltd., Sydney:
"Radiotronics," Vol. 20, Nos. 2 and 3, February and March, 1955.
General Publications Received:
"Break-in," Vol. XXVIII, No. 4, April, 1955.
"das Elektron," January, 1955.
"Electrical Industries Export," Vol. 55, No. 3, March, 1955.
"Electronic Engineering," Vol. 27, No. 325, March, 1955.
"Elektrotehniski Vestrik," 1954, 11-12.
"The Gramophone," Vol. XXXII, No. 381, February, 1955.
"G.E.C. Journal," Vol. XXI, No. 4, October, 1955.
"N..Z Electrical Journal," Vol. 28, No. 4, April, 1955.
"N..Z Electrical and Radio Trader," Vol. 1, No. 10, April, 1955.
"N.Z. Manufacturer," Vol. 6, No. 9, April, 1955.
"QST," Vol. XXXIX, Nos. 1 and 2, January and February, 1955.
"Radio-Electronics," Vol. XXVI, Nos. 3 and 4, March and April, 1955.
"La Radio and TV Revue," Vol. 7, No. 3, March, 1955.
"Radio and Television News," Vol. 53, No. 2, February, 1955.
"Service," Vol. 24, No. 2, February, 1955.

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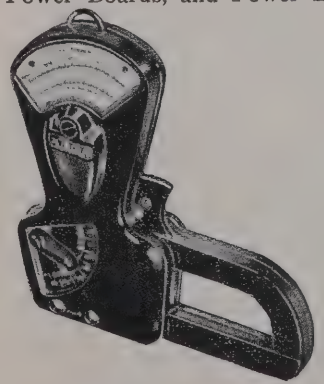

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MARCONI NEWS

In many fields in many countries, Marconi's Wireless Telegraph Company Limited, and its associated Companies, continue to contribute in no mean fashion to the high reputation of British radio, television and electronic manufacturers.

Through Marconi Italiana, Radio Audizione Italiana has recently placed a most valuable repeat order with Marconi for two further television outside broadcast units, the equipping of another two-camera studio, and a large quantity of monitoring apparatus. The new contract calls for the provision of eight camera channels, three sound and three vision mixers, twenty picture monitors, ten picture and waveform monitors, six line strobe waveform monitors, five microwave links and ancillary equipment.

Under the terms of a recent contract, Marconi's are to supply to the Egyptian Government navigational radar equipment, radio transmitters, receivers and associated test equipment for use aboard five warships of the Egyptian Navy. Each ship is to have a Marconi Radiolocator IV and a Transarctic transmitter/receiver. A further complete Radiolocator IV will be supplied for training and maintenance purposes. In addition, eight Marconi communications receivers of various types will be supplied for allocation among the ships.

Designed for use in ships, lightships, coastguard stations or by harbour authorities, the Marconi Radiolocator IV enables a strict watch to be kept on shipping in dangerous or restricted waters under all weather conditions and during the hours of darkness. Installed aboard ship it provides the Navigating Officer with an accurate and detailed picture of the position and movement of all shipping within the area, and thus does much to reduce delays and hazards due to fog. It is also of the utmost value when entering or leaving harbour, as an accurate picture of the coastal contours, and off-shore objects such as buoys, is presented on the viewing screen. A choice of one, three, ten, or forty-mile range can be selected by the turn of a single control.

The Transarctic equipment is a compact, self-contained 60 watt battery-operated transmitter/receiver, designed for both radio-telegraphy and radio-telephony work on Marine frequency bands.

In another sphere, Marconi's have just completed the design, manufacture and installation of two high-power, long wave broadcast transmitters at Klofta in Norway (operating on 218 kc/s.) and at Kalundborg in Denmark (245 kc/s.)

Other 100 kw. transmitters have been installed recently in Sweden, Finland, Egypt ,India, Cyprus and the Argentina. All are air cooled throughout, thus affording very considerable economies in operation and maintenance costs. In comparison with the older water-cooled types the new transmitters can save their overall cost in ten years or less. So reliable has this system proved that it is eminently practicable to operate them by remote control.

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CHRISTCHURCH

Hearing-aid Amplifier

(Continued from page 20.)

to match 10,000 ohms to 5 or 6 ohms, but, since a universal output transformer has been specified, this would not create any difficulty.

Another dodge would be to use an ECL80 triode-pentode. The triode section could be used as the voltage amplifier, while the pentode section could be triode connected and used as the power output stage. Other alternatives will no doubt suggest themselves to experimentally inclined readers.

INDIVIDUAL VOLUME CONTROL

The gain control on the amplifier chassis is not meant as a volume control to adjust the output each earpiece is receiving. Rather, it is adjusted so that the output stage is just not overloaded, so that it is giving its maximum power output at all times. Individual earpieces are then given their own volume controls. These can take the very simple form of a 500 or 1000-ohm potentiometer, used as a variable resistor in series with each earpiece. This system will no more upset the amplifier than will complete disconnection of any number of the headphones, and it will give very smooth volume control. This system ensures that under no circumstances can the individual listener overload his earpiece by adjusting his control.

N.Z. Radio Traders' Federation Annual Report

(Continued from page 44.)

Electrical Condensers

"The Board of Trade held a hearing on this question last October. Through the apathy of members, your Federation could not present as strong a case as was possible. It is of interest to note that the Manufacturers' Federation did not state a case for free importation of condensers. In reply to our inquiry as to when the Board would give its decision, the reply was to the effect that no specific date could be given.

Power Board Trading

"This is a subject that is of vital importance to all members, and it is hoped that as a result of discussion during the Conference, ways may be found to protect members' interests. It was considered by your Executive that action should be taken on a national basis and support should be obtained from electrical wholesalers and the Retailers' Association."

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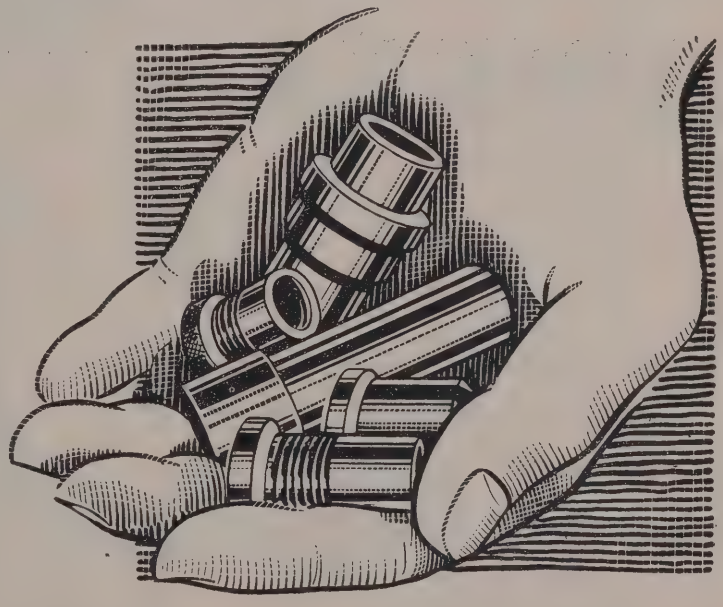

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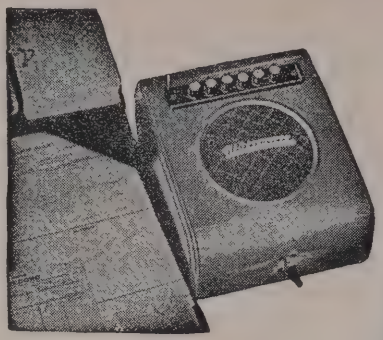
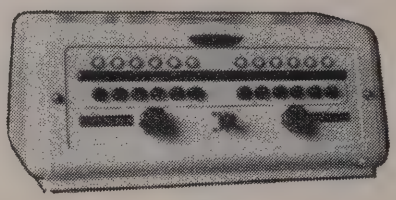
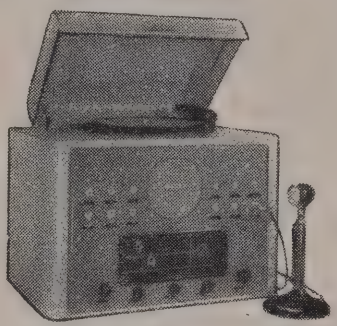


Intercommunication

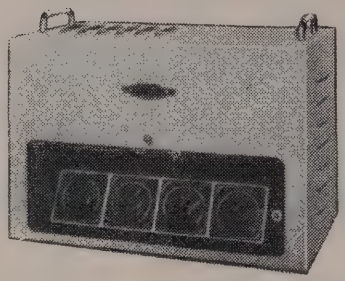


Control Equipment



Sound Equipment for Schools

Public Address Equipment



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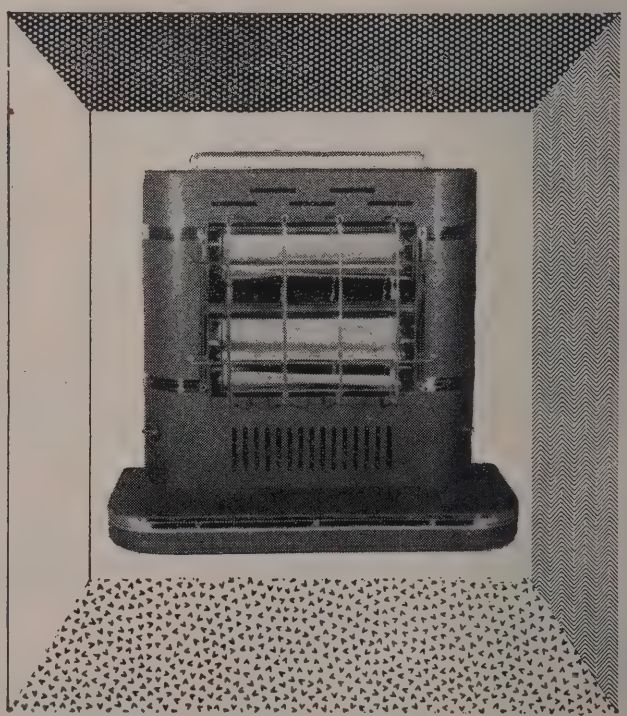

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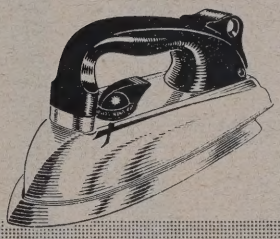

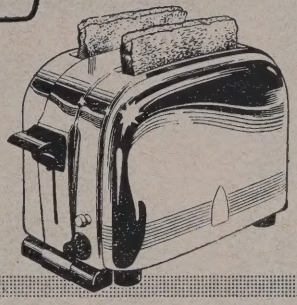

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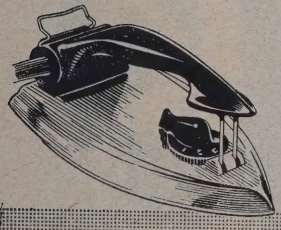

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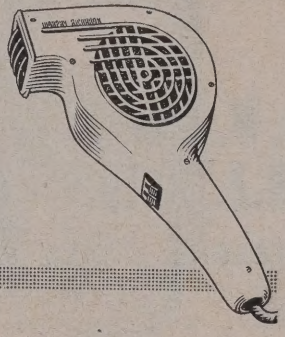

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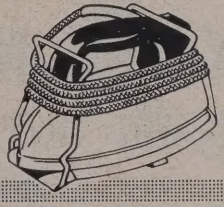

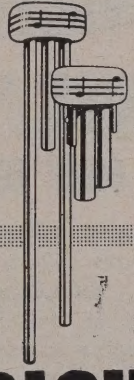

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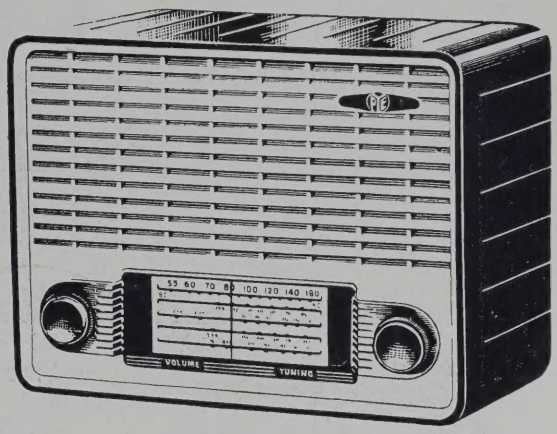

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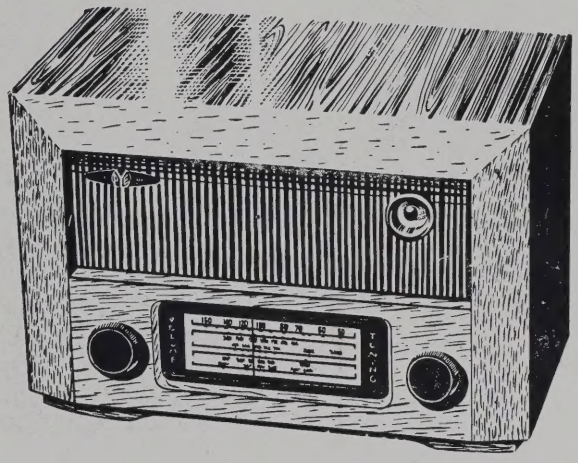

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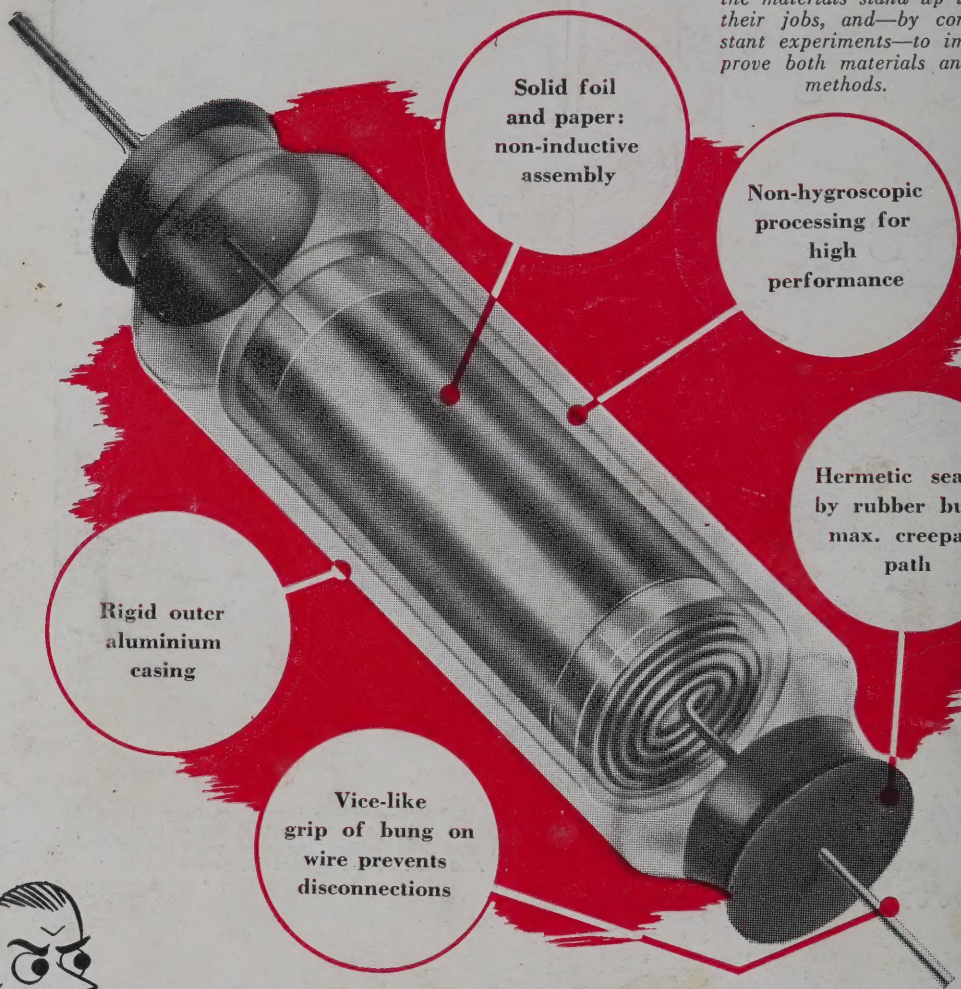

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